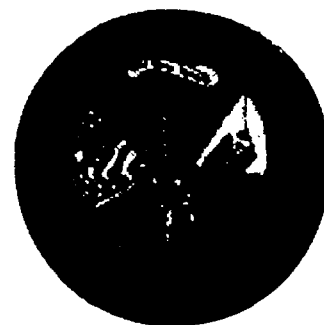


Preamble



U.S. ARMY PROPOSED UTAH CHEMICAL AGENT RULE (UCAR) FOR CONSIDERATION BY THE STATE OF UTAH

**Revised Waste Listings,
Land Disposal Restrictions
and Exemptions for
Nonhazardous Wastes**

**SUPPORTING
PREAMBLE**

Prepared by:

**U.S. Army Land Disposal Restrictions - Utah Group (LDRUG)
Department of the Army**

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**STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF SOLID AND HAZARDOUS WASTE
ADMINISTRATIVE RULEMAKING**

**UTAH ADMINISTRATIVE CODE
R315-1 TO R315-14, R315-50, AND R315-101**

**Revised Waste Listings, Land Disposal Restrictions
and Exemptions for Nonhazardous Wastes**

Action: Proposed Rule

Preamble

I. AUTHORITY¹

This section to be prepared by DSHW.

¹ Background Document A contains a list of acronyms used in the proposed rule and Preamble.

II. BACKGROUND

On July 1, 1988, the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW), modified its Solid and Hazardous Waste Regulations under Parts R315-2-10 and R315-2-11 to add specific chemical agents and associated wastes to its lists of hazardous wastes (DSHW 1988). Chemical agents and associated wastes were not then and are not now listed by the U.S. Environmental Protection Agency (EPA) under the Federal Resource Conservation and Recovery Act (RCRA). Hence, these wastes, while classified as hazardous within the State of Utah, are not regulated as hazardous wastes under the federal RCRA program. The current Utah regulatory program for these wastes is summarized in Section IV of this Preamble.

On January 6, 1995, DSHW announced a public "Initial Scoping Meeting" regarding plans to reexamine its current hazardous waste listings for agent wastes and to establish land disposal restriction (LDR) treatment standards for these wastes.² The DSHW letter announcing the Initial Scoping Meeting is provided in the Administrative Record for the currently proposed rule (also referred to as "today's" proposed rule) (DSHW 1995a). The public meeting was held on February 13, 1995. Documentation distributed by DSHW and an attendance list for the meeting are available in the Administrative Record that supports today's proposed rule (DSHW 1995b). During the meeting, DSHW outlined the new program, focusing on information that was perceived to be needed from the Army to support the rulemaking effort. A number of information requirements were identified, and the Army committed to responding to the state's requests for information.

The Army designated its Soldier and Biological Chemical Command (SBCCOM) [formerly the Chemical and Biological Defense Command (CBDCOM)] as the lead agency to work with DSHW in providing the information needed to develop and support a rulemaking. The SBCCOM subsequently established the Land Disposal Restrictions — Utah Group (LDRUG, also referred to herein as the group) to work with DSHW on the rulemaking. The group was established to coordinate the Army's efforts to provide the state with relevant information as it proceeds toward the proposed and final rule. The membership of the group includes regular Army and civilian staff from several Army agencies and

² LDRs were mandated for wastes designated as hazardous under the federal RCRA program by the 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA. In essence, LDRs are treatment requirements that must be met before land disposal. Additional information on EPA's LDR standards is provided in Section V of this Preamble. LDR standards proposed today for chemical agents and associated wastes are described in Sections IX and XI of this Preamble.

organizations. DSHW recognized that the military, in particular the Army, is the nation's expert with respect to conventional and chemical munitions, and that the Army's input would be critical. The Army has devoted significant resources to assist the DSHW in this rulemaking effort.

On February 28, 1996, DSHW met with the group to discuss plans for developing the proposed rule. During the meeting, DSHW provided the group with the state's initial draft of the *Administrative Rulemaking Chemical Agent Listing Land Disposal Restrictions*, which is included in the Administrative Record supporting today's proposed rule (DSHW 1996a). The DSHW invited the group to submit comments on the draft administrative rule. The group developed preliminary comments; these comments, dated March 22, 1996, are included in the Administrative Record for today's proposed rule (LDRUG 1996a). The Army's preliminary comments on the DSHW draft administrative rule, as indicated in the March 22, 1996, submittal, are predicated on three basic principles, as iterated below:

- *Chemical agents should be regulated in the same manner as are similar toxic materials generated by private industry in the State of Utah.*
- *The primary basis for determining the level or stringency of regulation should be the potential risk that a release of a substance would pose to human health and the environment.*
- *There should be a reasonably acceptable relationship between the cost of a regulation and its anticipated benefits.*

The group also indicated to DSHW during the February 28, 1996, meeting that many of the waste streams that would result from treatment of chemical agents and treatment of materials that were exposed to chemical agents (such as would be necessary to meet LDR standards) would no longer contain the chemical agents (or other toxic compounds) in significant amounts. These streams include, for example, incineration waste streams (e.g., incinerator ash) and chemical neutralization waste streams (e.g., decontaminated solids). The group suggested that these waste streams no longer pose a significant hazard to human health and the environment and proposed that exemptions for these wastes be developed as part of the rule.

The DSHW agrees that, if it can be shown that waste streams pose no significant risk to human health and the environment, these waste streams could be excluded from control as a RCRA Subtitle C hazardous waste. However, wastes relieved from Subtitle C control as a hazardous waste would remain

regulated under the State's Subtitle D program for nonhazardous wastes. DSHW agreed to incorporate a mechanism into the rule that would relieve from RCRA Subtitle C hazardous waste controls wastes that are determined to pose no significant risk to human health and the environment.³ This mechanism is proposed herein. (See Section X of this Preamble for details.)

DSHW and the group met several times after the February 28, 1996 meeting to discuss various aspects of the rulemaking. Formal meetings were held on the following dates:

- July 17, 1996,
- October 30, 1996,
- May 7, 1997,
- September 15, 1997, and
- October 16, 1997.

Minutes for formal meetings are provided in the Administrative Record for today's proposed rule (LDRUG 1996b-c, 1997a-c).⁴ Note that while informal discussions between DSHW and the group occurred during 1998 and 1999, no formal meetings were held.

³ The EPA had proposed a rulemaking known as the Hazardous Waste Identification Rule (HWIR) on December 21, 1995 [60 Federal Register (FR) 66344], which proposed exemptions (e.g., exit levels) for low-risk wastes. While DSHW had significant concerns with respect to EPA's proposal, DSHW nevertheless agrees with the exemption concept. The proposed HWIR rule is summarized, along with other pertinent EPA rules and activities, in Section V of this Preamble.

⁴ Note that the group prepared these meeting minutes and submitted them to DSHW for review and approval as final drafts. DSHW did not request any modifications to the minutes; hence, they remained in final draft form.

III. CURRENT ARMY PRACTICES

A. INTRODUCTION

This section describes and discusses current Army practice in the management of chemical warfare agents and their associated waste streams, particularly the risk management aspects of the overall system. The purpose of this discussion, in addition to providing general background information, is to establish a general framework for considering similar issues in the context of the proposed rule. Likewise, the Army hopes to help avoid any unnecessary confusion or misconceptions that could otherwise arise regarding the relationships between past, current, and proposed practices. The Army firmly considers its current practices as safe and appropriate measures to ensure public and environmental health. The Army views the requirements established by this proposed rule as additional steps that will further demonstrate and validate the protectiveness of current practices.

B. GENERAL

1. Guidance Sources

The primary guidance from the Department of the Army (DA) for the safe handling and management of chemical warfare agents is contained in Army Regulation (AR) 385-61, *Toxic Chemical Agent Safety Program* (DA 1997a), and the further implementing instructions contained in its associated DA Pamphlet 385-61, *Toxic Chemical Agent Safety Standards* (DA 1997b). Other pertinent official publications containing guidance of a directory nature include AR 50-6, *Chemical Surety* (DA 1995), and Technical Bulletin, Medical (TB MED) 577, *Sanitary Control and Surveillance of Field Water Supplies* (DA undated). Other doctrinal publications, such as Field Manuals, are oriented toward tactical operations and procedures and addresses such issues as chemical protection, training, and decontamination procedures. In addition, letters (or memorandums) on specific subjects and supplemental policy statements may also be occasionally issued by DA headquarters. These types of communications are normally intended to address rather narrow issues or are of a temporary nature (although their content may eventually become included in regulations). Finally, technical manuals (TMs), which provide technical information on specific subjects, form an important category of DA publications that may deal with chemical agent issues. TMs, although often referenced in regulations and pamphlets, are not normally themselves considered to be directional in nature.

These regulations, pamphlets, and other publications issued by DA are often supplemented by major Army commands (MACOMs), installations, and local organizations. The provisions of these documents may be more stringent, but not less so, than the parent DA reference. Standing Operating Procedures (SOPs) are examples of an important category of such local publications that address the very specific operational details and procedures of particular processes.

In general, then, a DA regulation will outline a basic philosophy for treating a broad subject, indicate the overall goals and objectives of the prescribed actions, and assign the specific roles and responsibilities of the affected organizations. A DA pamphlet will elaborate on these topics and provide additional "how to" guidance. The various MACOM and installation publications will then address the necessary specific details associated with local-level implementation of the higher headquarters guidance. Exceptions or waivers to specific provisions of the various guidance documents may, at least in principle, be obtained on a case-by-case basis from the issuing command, provided that the spirit or substance of the guidance is followed and that the overall goals and individual facilitating objectives are achieved.

2. Primary Focus

The Army's chemical warfare agent management system has focused primarily on requirements for two different types of situations, or scenarios. One is the tactical or wartime scenario, and the other is the operational scenario for agent processing and management facilities. For the tactical scenario, the primary goal has been identification of and protection against large quantities of purposefully released chemical agent. The doctrine and policies for this situation address prevention of troop exposures to agent concentrations that may result in clinical signs and symptoms, including death. These agent conditions and levels are generally not considered acceptable in situations involving worker or other civilian populations; therefore, the Army doctrines and policies regarding tactical situations are not considered relevant to this rule-making. Except in a few specific cases where historical associations have been made between tactical requirements and waste management, tactical doctrine will not be described in this section.

The other type of scenario for which several applicable requirements have been established by the Army includes operations at Army chemical agent research, storage, and disposal/treatment (demilitarization) facilities. This scenario is the primary focus of this rule. Research facilities generally only handle minimal quantities of neat (pure) agent; the storage and demilitarization facilities generally involve significant quantities of the agents in their neat form. These operations range from the large-scale destruction of the nation's chemical weapons stockpile to routine maintenance and inspection activities at existing storage sites. The types

of individuals potentially exposed during such operations include military, civil service, and civilian (contractor) personnel.

Particularly in the case of depot (storage) activities, individual occupational health concerns take priority over operational matters. This philosophy, followed in general nationwide in all variety of industrial operations, is taken to particularly stringent limits in the case of chemical agents, because of the unique ability of these substances to produce extremely harmful, even lethal, consequences if not handled properly. The federal government, with the Army acting as its executive agent, has responsibly chosen to provide the additional resources that are required under such circumstances and to accept the reduced operational efficiency that necessarily follows from the implementation of a complex and strict system of precautionary measures. It must be remembered, however, that the overall context for much of that system has been an environment in which there is some realistic possibility for exposure, on a repeated basis, to agent quantities or concentrations with the potential to cause significant and immediately harmful effects. Residual concentrations and small quantities of agent have over time become more explicitly considered and are now dealt with quite protectively in daily operations by the same measures designed for potentially far more harmful quantities.

The following sections describe some of the specific provisions established by the DA to ensure protection of public health and the environment. In addition to these requirements, the Army also defers to applicable state and federal environmental and public health laws and requirements.

A. REGULATIONS: GENERAL SURVEY OF PROVISIONS

1. Army Regulation (AR) 385-61, *Toxic Chemical Agent Safety Program*

AR 385-61 is the primary document that establishes the Army-wide chemical agent safety program. It encompasses issues related to the "processing, handling, storage, transportation, disposal, and decontamination" of the primary chemical agents in the U.S. military stockpile, namely blister agents H, HD, HT (sulfur mustards), L (lewisite), and nerve agents GA (tabun), GB (sarin), and VX. The provisions of AR 385-61 also apply to agents present, or expected to be present, in only relatively small quantities in the Army inventory, such as nerve agent GD (soman), and any experimental chemicals of similar toxicity to those listed above. Within the broad categories of safety issues listed above, the regulation describes, and prescribes, equipment and procedures related to such areas as agent detection and monitoring, personnel protective clothing, decontamination and disposal, and training. It also mandates that a systematic inspection system be established to periodically monitor compliance with the many

provisions of the regulation. Although the regulation is primarily directed toward depot-scale operations, laboratory activities are also included within its scope.

The cardinal principle prescribed by AR 385-61 for chemical agent operations is the prevention of exposure. Operational procedures are expected to be designed to strictly limit, to the degree consistent with the efficiency, safety, and object of a given activity, the number of people, amount of time, and quantities of agent involved. All individual elements of the regulation then follow in support of this principle, such as the required monitoring and control procedures, protective clothing requirements, and other provisions. Although many of these provisions may appear to be directed toward Army personnel operating on Army installations, a direct consequence of the proper execution of the requirements is the prevention of exposure to the public as well. Protection of public health is also the direct intent of the regulation, as can be seen from the particular treatment given to the decontamination (i.e., neutralization) and subsequent disposal of chemical agents.

The rigorous "3X/5X" system established for the decontamination of material suspected of being contaminated with chemical agents, although an occasional source of confusion if not viewed in its original context, has been designed to strictly minimize the possibility for external release of even the smallest quantities of chemical agent. What uncertainty may exist regarding the system has arisen largely from inappropriately connecting the specific purpose of the system and its various provisions with related, desirable, but different goals. That is, attempts are sometimes made to use the system for purposes for which it was not specifically designed.

Under the system, material potentially contaminated with chemical agents must be decontaminated thoroughly (according to documented, locally approved procedures) and then checked for the possible emission of agent vapors. (The head space around the material is sealed to the extent possible and allowed to reach thermal equilibrium.) If, following treatment, the concentrations of agent in the surrounding air space are found to be below specified limits (e.g., the worker 8-hour time-weighted averaged airborne exposure limits [AELs]), the material is declared to be "3X," implying acceptable surface decontamination. (DA Pamphlet 40-8 [*Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX* (DA 1990)] and DA Pamphlet 40-173 [*Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT* (DA 1991)] specifically describe the AELs.)

Workers are allowed to approach and handle 3X items with only a minimum of precautions. It is important to note, however, that such material or items are

safe from the standpoint of both physical contact and close association for a period of time but must remain under government control and responsibility. This 3X requirement ensures the safe disposition of the material in a disposal facility that is permitted under Subtitle C of the Resource Conservation and Recovery Act (RCRA) to receive hazardous wastes and is in full accordance with applicable federal, state, and local environmental regulations. The 3X requirements also specify packaging, tracking, and disposal requirements that are designed to protect public health. The Army considers it important to closely track the history and disposition of material in the classification system. Strict labeling and record-keeping requirements are specified in the Army regulation, as are the capabilities of the analytical procedures to be used and their associated quality control and quality assurance procedures. (The Army requires 3X material to remain under government control; hazardous waste disposal facilities permitted under RCRA are considered to meet that requirement.)

As can be seen from the brief description above, the Army does not consider 3X material to be completely agent free or completely risk free. Such descriptions are reserved for "5X" material, which may be released from Army control provided that such release is in accordance with all applicable federal, state, and local regulations. To be considered completely risk-free, an item must either be heated to 1,000°F for 15 minutes (an incineration treatment considered to be sufficiently severe to destroy all agent molecules) or otherwise treated in a manner capable of such extensive agent destruction that the total quantity of agent can be shown to be below a level determined by the Army Surgeon General to represent no adverse health effects. For any alternative to incineration to be used, the procedures and analyses must be submitted through the appropriate higher headquarters channels.

In practice, the incineration methods have been the only applied 5X techniques. Accordingly, given the intensity of the incineration process, 5X material has had no detectable remaining chemical agent associated with it. More recently, alternative large-scale demilitarization processes involving chemical neutralization are being investigated for some Army storage depots.

It is important to note that the use of the 3X and 5X designations by themselves is not entirely adequate for the purposes of thorough baseline health risk assessments (as, for example, can be required under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]). The data generated as part of the classification process are clearly pertinent to such assessments, and much useful information can be inferred from a particular classification, but the designations themselves may not indicate actual agent concentrations in a particular material or media. The classifications are quite suitable for their intended purpose — segregating material for the purpose of prescribing its proper handling, treatment, or disposition. In addition, the

classifications have been used to successfully prevent exposures and adverse health impacts to both military and civilian occupational populations, as well as to the general public.

In summary, the cumulative effect of all the measures mandated by AR 385-61 and its accompanying DA pamphlet is to markedly reduce the potential for exposure to chemical warfare agents in any measurable concentration, regardless of whether that exposure might be to soldiers, Army civilian workers, or the general population. Such an effect is indeed consistent with the stated overall goal of the regulation.

2. Army Regulation 50-6, *Chemical Surety*

The Army's chemical surety program was developed as an outgrowth of the existing nuclear surety program, which instituted an extensive and very rigorous set of controls and procedures to ensure that nuclear weapons or material would not fall into unauthorized hands. Strict security measures, thorough background checks for personnel, personnel qualification and training, the "two-man rule" to prevent individual access to surety material, periodic inspections, and other measures were all part of the nuclear surety program's elaborate system of requirements. These requirements were all carried over into the analogous chemical surety program, as established under AR 50-6 (DA 1995). Also included in AR 50-6 are safety and transportation requirements and related measures. Thus, surety in this context is a combination of complementary safety and security measures designed with the primary goal of restricting unnecessary or unauthorized access to chemical weapons, or to significant quantities of chemical agents.

The underlying purpose of this goal, in turn, is to prevent exposure of the public, but once again with the primary focus on amounts or configurations of agent material that can be immediately harmful. It is noteworthy that research, development, testing, and evaluation (RDT&E) dilute solutions are specifically exempted from the provisions of AR 50-6. The regulation stipulates (Table 9-1) both maximum concentrations (ranging from 1 mg/mL for VX to 10 mg/mL for sulfur mustard) and maximum total agent quantities (from 10 mg for VX to 100 mg for HD) for these solutions. Because these relatively small amounts and concentrations can be readily considered to present a noticeably reduced risk level, the Army does not subject them to the extremely strict regime of treatment in accordance with all the requirements of the surety program. In no way, however, are they considered to be completely exempt a priori from the requirements of the Army's chemical agent safety program nor from applicable federal, state, and local regulations.

The same general considerations apply to potentially contaminated soil or other environmental media. These media are not to be regarded as chemical surety material even in the general sense (unless, of course, the concentrations are so large that the media present an immediate, acute hazard, or could be easily seen to be a practical source from which harmful quantities of agent could be extracted), but they are still subject to the relevant provisions of the chemical agent safety program.

Similar to some aspects of the Army's safety program, the surety program has been the source of some misconceptions. Also as in the case of the safety program, most of these misconceptions arise from a mismatch between the actual objective of a particular provision and a presumed related, but distinctly different, purpose. Accordingly, the best way to prevent such misunderstandings is to keep in mind that the primary purpose of the surety program is to prevent the unauthorized access to chemical munitions or significant quantities of the neat agents themselves, along with their subsequent use, and the attendant large-scale harmful consequences. The application of AR 50-6 to environmental matters should, therefore, be limited to a strict interpretation of its specific provisions and their respective objectives. Nonetheless, there are obvious indirect impacts or connections. The overall effect of the surety program is to further the goal of limiting exposure to neat chemical agents; at the same time, it does establish a context for the use of health-based considerations in risk management decisions involving only residual or small quantities of agents in reduced concentrations.

3. DA Pamphlet 40-8 (*Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX*) and DA Pamphlet 40-173 (*Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT*)

DA Pamphlets 40-8 and 40-173 (DA 1990, 1991) describe the requirements established by the Army's Medical Department and Office of the Surgeon General regarding protection against exposure to airborne concentrations of chemical agents. These requirements are generally incorporated either directly or by reference into other Army requirements (such as AR and DA Pamphlet 385-61, described above). Of specific application and relevance to this rulemaking are the specific airborne concentration limits described by these DA pamphlets. Airborne concentrations of hazardous substances that must not be exceeded under various conditions are commonly specified in the field of occupational health. The general term AEL is used here to refer to a variety of limits of airborne exposure. Concentration values differ, even for the same substance, depending on the specific purpose or type of limit. (For example, the permissible concentration for exposure on a time-weighted average [TWA] basis for an 8-hour workday would be

expected to be considerably lower than a threshold limit cited as an immediate acute hazard.) The Army, in Chapter 2 of AR 385-61, has listed a variety of applicable criteria for chemical agent operations. Detection and monitoring capabilities are mandated in accordance with these standards, as are personnel protection requirements (both garment and respiratory). Likewise, in 1988 the Centers for Disease Control endorsed the airborne concentration limits applicable to the general public. These limits have been an important factor incorporated into the design and operation of chemical demilitarization facilities.

These airborne concentration limits are, at the time of this rulemaking, undergoing a re-evaluation. Although no new toxicological studies have been performed, some historical data have recently become available, and, in addition, new approaches to evaluate and interpret such data are now being applied. As of March 1999, the G-agent evaluation (*Evaluation of Airborne Exposure Limits for G-Agents: Occupational and General Population Criteria*, Mioduszewski et al. 1998) has been completed. In addition to validating the primary airborne limits of interest (lifetime occupational 8-hour and general population limits), additional values are established for shorter-term durations, to include worker short-term exposure limits and general population airborne exposure guideline levels for 0.5 to 4 hours. These reports will be incorporated into revised updates of DA Pamphlets 40-8 and 40-173. The reevaluations of VX and HD are scheduled for completion in fiscal years 1999 and 2000, respectively.

Despite the potential future recommendations for modifications to existing AELs, the Army maintains that its operations and procedures have been adequately protective of occupational workers (to include military, civil service, and civilian contractors) and the public. As described previously in this section, several procedures and requirements are in place to prevent the exposures that are theoretically "acceptable" according to these AELs. For example, an 8-hour worker TWA level is, by definition, a concentration that an unprotected worker (adult) can be exposed to for 8 hours a day for 5 days a week for up to 30 years. Similarly, the general population "72-hour" limit⁵ actually represents a concentration that the susceptible public (e.g., children) may be exposed to for a lifetime without suffering adverse effects.

As described previously, by the same standards with which the Army has historically established all its chemical agent safety and surety provisions, the tendency has been to provide for extra conservative measures given the assumed conditions of large quantities of neat agent. This tendency for conservatism has resulted in extreme precautions regarding protective equipment, engineering

⁵ Note that the "72 hours" was originally a reference to the time required to obtain a sufficient sample to detect the stated concentration.

controls, and monitoring standards. With regards to the intent of this proposed rule, the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has cited concerns about the potential for less stringent standards to be followed by facilities not directly managed by the Army. The requirements to be established by this rule-making will therefore provide further validation and assurance that current Army practices are appropriate and adequate to protect potentially exposed populations.

D. OTHER RELEVANT SPECIFIC ISSUES

1. TB Med 577, *Sanitary Control and Surveillance of Field Water Supplies*

TB Med 577 establishes tactical requirements regarding the issue of safe drinking water supplies for soldiers in a combat zone. It sets concentration standards (referred to as field drinking water standards, or FDWS) for sources of field drinking water for the various U.S. and threat (enemy) agents that could conceivably be used in large quantities to contaminate water supplies for tactical units. At concentrations below the standards, the water is presumed to be safe for consumption by the soldier for a period of 7 days (based on default consumption rates of 5 to 15 L of water a day).

As stated previously, the intention of this section and the proposed rule is to focus on the requirements applicable to safe management of chemical agent related waste residues. Although it is unclear as to the initial basis for its application to such issues, the Army's FDWS have been used in many cases as a basis for declaring that a given liquid waste stream is adequately neutralized, at least as an initial treatment to relieve its status as "chemical agent." Presumably, if the liquid is safe enough to drink, at least from the strict point of view of the chemical agent contamination, then it is reasonable to consider the waste sufficiently safe to otherwise handle in cases where ingestion is not expected to occur. Application of such standards to delineate what can safely be disposed or managed through a RCRA Subtitle C permitted treatment facility is clearly a very conservative approach. This proposed rule will establish more realistic waste management criteria, particularly for such wastes that will continue to be managed and disposed of as hazardous wastes through appropriately permitted facilities.

The same general line of reasoning has been used as a basis for recommending target low-end concentrations to be used in the development of chemical analysis capabilities for agents in various media. Once again, it was presumed reasonable that if a particular method or technique for liquid analysis could detect agent concentrations at least as low as (preferably somewhat lower

than) the drinking water standards, then it was quite likely to be suitable for other applications as well. As before, this approach was considered to be rather conservative because it is difficult to envision a situation in which massive amounts of waste materials assumed to be contaminated to levels near the drinking water standards are ingested repeatedly in any handling process. Thus, the numbers in question represent a very conservative manner of dealing with the issue.

It is important to note that the publishing of safe drinking water standards for field supplies that are potentially contaminated with chemical agents is not at all an indication that the Army considers the contamination of groundwater by these chemicals (at least at reasonable distances from a putative release point) to be an equally likely occurrence. Considerable difference exists between the temporary contamination of surface water sources in an area over which large-scale employment of chemical weapons is presumed to occur and the contamination of an aquifer. A variety of attenuation factors, such as hydrolysis, can reasonably be expected to reduce any initial agent contamination in groundwater to essentially de minimis levels over times that compare favorably with the (typically longer) times associated with groundwater flow. (See Appendix E of Background Document E for additional information on groundwater contamination.) On the other hand, the effects of short-term, widespread, or intense deliberate dissemination of chemical agent cannot be expected to be immediately dissipated and could potentially persist for relatively long periods during which local surface water supplies might be the only available potable water source for some combat units.

In summary, the FDWS have been a frequent source of confusion when they have been used for purposes other than their original objective. Indeed, it is reasonable to assume that, in most cases, the use of consumption-related standards represents considerable additional conservatism in making risk management decisions in matters where exposures are expected to be considerably less severe. The Army itself has used this rationale in past and current operations because more reasonable criteria were not available. Nevertheless, their use in the chemical agent safety program for certain depot or industrial operations has had the same overall goal and ultimate effect as other elements of the Army's chemical agent programs, namely, the prevention of adverse health impacts to all concerned including both within the Army and the public.

2. Personnel Protection Requirements

AR 385-61 and its companion DA pamphlet (DA 1997a-b) contain a number of very specific provisions regarding the wearing of individual items of protective clothing and respirators, as well as the capabilities of the various elements. As

always, prevention of exposure is the objective, and the operative exposure scenarios are generally taken to be rather severe. Consequently, the protective clothing requirements are quite stringent, and the protective gear is often both very elaborate and extremely robust. These requirements are entirely appropriate for such occupational scenarios as depot workers or workers at a chemical demilitarization plant. Indeed, at such facilities, operational requirements such as visual acuity and communication needs are obvious sources of additional complexity in the protective equipment, compared, for example, with what would be sufficient basic protection downwind of a minor agent release.

Protective equipment for soldiers in tactical situations is likewise of necessity very robust and must incorporate a myriad of critical operational requirements. In addition to the obvious need for electronic communication capabilities and sensitive visual acuity, the total absorptive capacity and/or overall protection factor of protective masks/respirators (or "gas masks") must often exceed the corresponding demands of the workplace scenario. Also, for tactical use, additional chemicals must be incorporated into the normal activated charcoal filter elements, because of the potential need to prevent breakthrough of other compounds, such as hydrogen cyanide. Hydrogen cyanide has been used in the past as a war gas and must be considered in the protective equipment designed for tactical use. However, in the workplace hydrogen cyanide gas is specific to only certain types of operations, for which special equipment is then provided. Troop masks have often been used in depot activities because of their ready availability.

It is important to keep in mind once again that the enhanced protective measures incorporated in the Army's chemical safety program are principally designed against potential exposure challenges considerably greater than what would reasonably be expected with the same frequency in the general waste management scenario, in particular waste managed at a RCRA treatment, storage, and disposal facility. The level of protection required to work in relatively confined spaces, where the potential for immediately harmful, even lethal, concentrations of chemical agent exists, far exceeds what would be necessary for the relatively low-level exposures generally encountered in hazardous waste operations. Consequently, it could be misleading to attempt to draw conclusions from practices and equipment specifically focused on the demands of potential high-exposure situations and expect those conclusions to be strictly and universally applicable for use elsewhere. Once more, the Army's regime of protective measures goes far beyond what is necessary for simple basic protection. Some relaxation could be anticipated to be acceptable for situations in which far smaller agent concentrations and shorter exposure durations are presumed.

3. Modifications to Safety and Surety Regulations

As indicated above, the Army's chemical safety and surety systems provide, both implicitly and explicitly, for modifications to otherwise strictly prescribed procedures or requirements. Waivers to individual provisions may be obtained in specific circumstances (see, for example, AR 385-61, Chapter 3), but the process can be expected to be generally quite difficult. Rigorous and extensive justification is the norm, and approval authority is closely specified. For example, the overall controlling authority cited in AR 385-61 is the Chief of Staff of the Army, the highest ranking uniformed officer. It should be noted that the basis for a waiver request is a risk assessment [paragraph 3-2.c.(1)]; operational considerations are clearly important factors, but the final analysis depends on the assessment of the potential risk to public and occupational health.

Another important factor throughout the Army's programs is the use of engineering controls. Such measures (e.g., additional ventilation in a work area, a combination of physical barriers and induced draft to impede vapor transport, or the use of additional containment vessels or structures) can all be used to reduce, where appropriate, the need for more stringent procedures that might otherwise apply. Once again, the overall goal of exposure reduction cannot be compromised, and an effective risk assessment is the basis for decisions in such matters.

An example of the implicit consideration of overall risk to human and environmental health in the Army programs is the exemption from many of the more stringent provisions of AR 385-61 and AR 50-6 granted for both RDT&E solutions and potentially contaminated environmental media, such as soil. Both issues were briefly discussed previously, but the common theme in the way they have been approached is the relatively low risk posed by either type of material, when properly handled.

4. Advances in Assessing Low-Level Risks and Hazards

A distillation of the pertinent Army regulations on risk management issues associated with chemical agents shows that considerable conservatism is a general theme, and this conservatism increases noticeably as the database for making judgments becomes less complete. One of the most significant information gaps for chemical agents has been in the area of the effects of very low doses of these substances over long periods of time (i.e., chronic effects). This situation is hardly surprising, because the body of toxicological data on agents stems primarily from acute exposures. These studies were originally done in the early to mid-20th century. Their focus was either on developing effective offensive agents for wartime applications or on supporting protective measure decisions for troops. In each case, the primary health effects of concern were clinical signs and symptoms

that potentially impair the effectiveness of a soldier. The exposures evaluated were primarily acute, short-term exposures lasting less than an hour. Both animal and human toxicological and epidemiological data have been collectively evaluated (and are being evaluated again, as described above) in establishing the current airborne standards (AELs). The data have been extrapolated to fit today's populations of concern and the longer exposure durations of concern. The data gaps and uncertainties are addressed by adding "safety factors" to the resulting low-level estimates. These safety factors are considered to provide adequately conservative concentration estimates. Various studies, some related to recent interest in Gulf War illness, anticipated in the future may address various areas of uncertainty, but at the date of this rule-making, no new data are available.

Although the provisions described above have provided for an approach to minimize exposure against even low-level risks from airborne agent, these AELs do not completely address all exposure pathways. A particularly critical piece of toxicological information needed in making health-related decisions involving potential long-term exposures to very low levels of contaminants is the chronic oral reference dose (RfD). Expressed in units of mass of contaminant per receptor body mass, an RfD indicates a chronic lifetime daily ingestible dose of a chemical that would be expected to produce no adverse effects. When combined with (equally necessary) site-specific exposure information, the use of RfDs allows one to make rational estimates regarding the long-term health risks likely to be associated with given sites or material for such exposure pathways as incidental ingestion of residual contamination.

Although RfD values are commonly available and used in cases involving most industrial pollutants, they have, until recently, been lacking for the primary chemical agents. Consequently, general practices of 100% avoidance have often been the norm. However, the Army has sponsored an effort to investigate the existing literature on the subject of longer term, low-dose effects of chemical agents to ascertain if reliable chronic reference doses could be developed. As a result, the Army Surgeon General in 1996 published RfDs for nerve agents and sulfur mustard that are approved for internal Army use. The work has been reviewed by outside experts and is presently being further reviewed by the Committee on Toxicology of the National Research Council. This work has also been published by a peer-reviewed scientific journal (Opresko et al. 1998).

As a result of these efforts, the Army now has a firm scientific basis for proposing, where appropriate, alternatives to some of the more extreme practices (such as extensive use of incineration) involving materials potentially contaminated with low levels of chemical agents. As mentioned earlier, regulations and policy have always offered this flexibility, but only when justified by a health risk assessment, an analysis that could not be properly done without RfDs, when

chronic effects were at issue. It may be noted, for the sake of general perspective, that the RfDs for the agents are in most cases generally comparable to those of very toxic industrial pollutants, such as polychlorinated biphenyls or organophosphorous pesticides.

E. SUMMARY

The Army's current regulations and practices regarding chemical warfare agent operations are very well suited for their given purpose and have accordingly resulted in an exceptional safety record. In those instances where the Army itself has applied certain provisions (such as FDWS) to seemingly inappropriate situations, it has done so with the intent to ensure added conservatism in cases where the necessary standards or data were not available. As additional knowledge is acquired, particularly with respect to chronic toxicity issues involving agents and agent related wastes, the Army is modifying its provisions to ensure that its operations are continuously performed in the safest and most efficient manner. This rule-making is an example of this effort to incorporate the appropriate scientific and technical data into operational procedures.

In conclusion, the Army places a clear priority on an extensive and complementary system of risk-based measures designed to strictly control exposure to even the slightest amounts of chemical warfare agents. Where clear potential for causing extremely serious and direct harm is a matter of immediate concern, these agents are accorded special treatment indeed. When, however, such acute effects are not immediately at issue, the Army has the flexibility to address chemical agent issues in a manner more in keeping with those attendant to hazardous industrial contaminants. In all cases, responsible treatment of potentially harmful substances, regardless of source, is the clear overriding consideration.

IV. SUMMARY OF EXISTING STATE OF UTAH RULE

A. INTRODUCTION

The Resource Conservation and Recovery Act (RCRA) was intended by Congress to be a state-implemented program. The U.S. Environmental Protection Agency (EPA) was charged with developing a set of regulations that would define wastes as hazardous and establish a cradle-to-grave system for management of those wastes.⁶ States would then adopt those regulations and seek authorization from EPA to implement the RCRA program within their boundaries. EPA would implement the program within states that chose not to adopt and implement a hazardous waste program.

Those states that choose to adopt EPA's regulations may decide to seek authorization from EPA to implement only a portion of the RCRA program. Hence, some states only have authorization to implement the RCRA base program, which includes permitting and other basic elements, while other states have authorization to implement additional elements of the federal program, such as the Land Disposal Restrictions (LDRs) or RCRA Corrective Action programs. Additionally, in adopting EPA's regulations, the states cannot be less stringent than the federal program, but they can develop regulations for implementation within their state that are more stringent or broader in scope than those prescribed by EPA.

The State of Utah is authorized by EPA to operate the RCRA program in Utah. The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) administers the base RCRA program as well as other aspects of the RCRA program, including RCRA Corrective Action and the Land Disposal Restrictions. As EPA modifies its existing regulations and develops new regulations, it is DSHW's general intent to adopt those regulations. New or modified EPA regulations typically are adopted by the State of Utah within several years after being finalized by EPA.

The basic regulatory program for hazardous waste management in Utah is, therefore, based on the EPA regulatory program. In most cases, Utah has adopted EPA regulations without changes. EPA's RCRA characteristics and EPA's lists of hazardous wastes have been adopted in total by Utah. In other cases, DSHW has, however, developed regulations that are more stringent or broader in scope than the federal program. One of the most prominent examples to date is DSHW's set of regulations regarding "Nerve, Military, and Chemical Agents." EPA does not

⁶ The elements of EPA's RCRA program that are related to today's proposed rulemaking are described in Section V of this Preamble.

regulate chemical agents and associated wastes as hazardous waste through their lists of hazardous wastes. Because the military is a prominent industry in Utah, and especially considering the chemical agent missions of the Deseret Chemical Depot (formerly, Tooele Army Depot) and the Dugway Proving Ground, DSHW listed chemical agent wastes as hazardous wastes within the state.

DSHW's final rule that regulated nerve, military, and chemical agents was effective on July 1, 1988. Specifically, DSHW modified its Solid and Hazardous Waste Regulations under Parts R315-2-10 and R315-2-11 to add specific chemical agents and associated wastes to its lists of hazardous waste. In addition, under R315-50-9(1), DSHW added specific chemicals as a basis for listing chemical agents and associated wastes identified in R315-2-10. These DSHW regulations merely added specific chemical agents and associated wastes to the lists of hazardous wastes established by EPA that were subsequently adopted by DSHW. No new categories of waste listings were established, and no new or additional requirements for management of chemical agents and associated wastes were developed. The chemical agents and associated wastes were brought into the existing DSHW regulatory system for hazardous waste management in Utah and at that time became subject to DSHW's hazardous waste regulations in exactly the same manner as similar waste streams generated by private industry in Utah.

The remainder of this section summarizes EPA's listing categories and indicates how chemical agents and associated wastes are currently addressed in the DSHW regulations under these categories.

B. WASTE LISTING CATEGORIES

1. 40 CFR 261, Appendix VIII "Hazardous Constituents," as adopted in R315-2-10

Substances are listed by EPA as Appendix VIII hazardous constituents only if they have been shown in scientific studies to have toxic (including acutely toxic), carcinogenic, mutagenic, or teratogenic effects on humans or other life forms. The primary purpose of Appendix VIII is to support EPA's listing program, whereby, if EPA finds that a waste stream typically contains chemicals listed in Appendix VIII at significant concentrations, it will list such waste streams as hazardous wastes under 40 CFR 261 Subpart D — "Lists of Hazardous Wastes" (including wastes from both specific and nonspecific sources listed under 40 CFR 261.31 and 261.32, respectively, and commercial chemical product wastes listed under 40 CFR 261.33(e) and (f)). The presence of an Appendix VIII hazardous constituent in a waste stream, however, does not of itself make that waste stream a hazardous waste.

DSHW's 1988 final rule identified specific chemical agents as commercial chemical products [R315-2-11(e)]. The DSHW did not, in 1988, identify these chemicals as "hazardous constituents."

2. 40 CFR 261.33(e) and (f) "Discarded Commercial Chemical Products, Off-Specification Species, Container Residues, and Spill Residues Thereof," as adopted in R315-2-11(e) and (f)

40 CFR 261.33 contains two lists of chemicals: (e) and (f). Chemicals on the (e) list are sometimes referred to as "P" chemicals because EPA assigned hazardous waste codes for these chemicals that begin with the letter "P" (e.g., P123). Chemicals on the (f) list are sometimes referred to as "U" chemicals because EPA assigned hazardous waste codes for these chemicals that begin with the letter "U" (e.g., U123). These lists contain chemicals that meet EPA's definition of "commercial chemical product." The term "commercial chemical product...refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient" [40 CFR 261.33(d)(Comment)]. Chemicals that are not "manufactured or formulated for commercial or manufacturing use" would not be identified as commercial chemical products.

The difference between EPA's "P" and "U" lists is primarily a function of potency. Chemicals listed on the "P" list have been shown to be acutely toxic, while chemicals on the "U" list are listed because they have been shown in scientific studies to have toxic (but not acutely toxic), carcinogenic, mutagenic, or teratogenic effects on humans or other life forms.

EPA developed the lists of chemicals in 261.33(e) and (f) to ensure that chemicals that are discarded or intended to be discarded, for whatever reason (e.g., chemical has exceeded its shelf life, chemical is no longer needed), are regulated as hazardous waste under the RCRA program. DSHW's 1988 final rule identified specific chemical agents as commercial chemical products (R315-2-11(e)). Chemicals listed therein included CX, GA, GB, GD, H, HD, HL, HN1, HN2, HN3, HT, L, T, and VX.⁷ A generic waste code of P999 was applied to all the chemicals listed therein. This procedure was in contrast to EPA practice of designating chemical-specific codes (e.g., P901, P902, etc.). The DSHW did not, in 1988, identify any chemicals in the "U" category (toxic, but not acutely toxic).

⁷ See the list of acronyms in Background Document A for the complete chemical names of these compounds.

3. 40 CFR 261.31 "Wastes from Non-specific Sources and 40 CFR 261.32 "Wastes from Specific Sources," as adopted in R315-2-10(e) and (f)

As indicated in 40 CFR 261.33(d) Comment, the listings in 40 CFR 261.33(e) and (f) do "...not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f)." EPA further indicates under the 40 CFR 261.33(d) Comment that where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraph (e) or (f), such waste will be listed in either Section 261.31 or 261.32. EPA has therefore listed a number of waste streams under these sections, with wastes from nonspecific sources (generated by more than one industry) in Section 261.31, and wastes from specific sources (generated by one industry, usually by specific processes) in Section 261.32. These waste streams become hazardous waste when they meet the listing description provided in the regulations. Wastes in the nonspecific sources category (Section 261.31) are noted with "F" hazardous waste codes (e.g., F001, F002), whereas wastes in the specific sources category (Section 261.32) are noted with "K" hazardous waste codes (e.g., K001, K002).

DSHW's 1988 final rule established a generic F999 waste code for "residues from demilitarization, treatment and testing of nerve, military and chemical agents." DSHW then listed the specific chemical agents to which the F999 waste code applied. These chemicals included CX, GA, GB, GD, H, HD, HL, HN1, HN2, HN3, HT, L, T, and VX [R315-2-10(e)]. Notice that these same chemicals were listed by DSHW in the P999 category. DSHW did not establish "F" or "K" codes for specific agent associated process waste streams. Also, DSHW's generic F999 code was in contrast to the EPA practice of designating waste-stream-specific codes (e.g., F901, F902, etc.).

4. 40 CFR 261 Appendix VII, Basis for Listing Hazardous Waste, as adopted in R315-50-9

To support listing of "F" and "K" wastes, EPA conducts a listing study, which includes examination of waste streams for the presence of Appendix VIII hazardous constituents. If EPA finds that certain waste streams typically contain significant amounts of Appendix VIII hazardous constituents, it will usually propose listing of these waste streams. EPA will also examine wastes to determine if they exhibit any of the four RCRA characteristics (40 CFR 216.21-24). EPA may decide not to specifically list waste streams if they typically exhibit one or more RCRA characteristics. EPA established Appendix VII of 40 CFR 261 to serve as a basis for listing. Accordingly, Appendix VII identifies specific hazardous constituents that serve as the "basis for listing" of "F" and "K" waste streams. Hence,

chemicals listed in Appendix VII should already have been listed in Appendix VIII, although EPA can, and has, established Appendix VIII listings at the same time that it has established "F" and "K" listings and listings in Appendix VII.

In the 1988 final chemical agent rule, DSHW included the chemical agents as the basis for listing the F999 hazardous waste listing and added these chemicals to R315-50-9 as Appendix VII constituents. The following chemicals were included: CX, GA, GB, GD, H, HD, HL, HN1, HN2, HN3, HT, L, T, and VX. Here again, these chemicals are the same ones listed in the P999 and F999 categories.

**5. 40 CFR 264 Appendix IX, Groundwater Monitoring List,
as adopted in R-315-50-14**

EPA has established, in 40 CFR 264 Subpart F, regulations pertaining to "Releases from Solid Waste Management Units." These regulations, which DSHW has adopted (R315-8-6, Groundwater Protection), establish requirements for groundwater monitoring at RCRA-permitted land disposal facilities. These regulations require detection monitoring for specific constituents and indicator parameters; if a statistically significant increase in these parameters over background is observed, the facility is required to implement compliance monitoring. Compliance monitoring entails, among other things, sampling and analysis of the groundwater for all 40 CFR 264, Appendix IX, groundwater monitoring constituents. DSHW did not include any of the chemical agents as additions to the Appendix IX groundwater monitoring constituent list in its 1988 final rule.

C. SUMMARY

In summary, the DSHW regulatory program for identification and listing of hazardous wastes is adopted from the EPA program. DSHW chose to be more stringent or broader in scope than the federal program, however, and in 1988 listed specific chemicals as hazardous waste in several listing categories under the general category of nerve, military, and chemical agents. DSHW chose at that time, however, to deviate from the EPA system of listing wastes in several important respects:

- Chemicals were added to the list of acutely toxic commercial chemical products under a generic waste code (P999) as opposed to the EPA practice of using chemical-specific codes.
- Waste streams were added to the list of waste streams from nonspecific sources under a generic waste code (F999) as

opposed to the EPA practice of using waste-stream-specific codes.

- Chemicals were added to the Appendix VII basis for listing, but were not added to the Appendix VIII list of hazardous constituents.
- No Appendix IX groundwater monitoring constituents were identified.

Furthermore, and equally important, DSHW did not identify additional or supplemental management requirements for these waste streams. Wastes regulated under the nerve, military, and chemical agents categories became regulated the same as any other industrial hazardous waste generated in Utah.

V. SUMMARY OF PERTINENT EPA PROPOSED AND FINAL RULES

A. INTRODUCTION

The hazardous waste regulatory program in Utah, and in other states as well, is based on the program developed by the U.S. Environmental Protection Agency (EPA). Therefore, it is important to review aspects of EPA's regulatory program that are relevant to today's proposed rule. It is also important to review rulemakings that EPA is now developing that may affect today's proposed rule. The purpose of this section, thus, is to provide background information on the EPA regulatory program for hazardous waste management, including proposed and final rules and new developments.

B. OVERVIEW

Subtitle C of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), directs the EPA to promulgate regulations to protect human health and the environment from the improper management of hazardous waste [Sections 1006, 2002(a), 3001 through 3007, 3010 and 7004; 42 United States Code (U.S.C.) 6905, 6912(a), 6921 through 6927, 6930 and 6974]. Subtitle C of RCRA establishes a federal program to provide comprehensive regulation of hazardous waste from "cradle-to-grave." Subtitle D of RCRA establishes the federal program concerning the management of solid (nonhazardous) wastes.

Section 3001 of RCRA Subtitle C directs the EPA to identify the characteristics of hazardous waste and to list particular hazardous wastes [40 Code of Federal Regulations (CFR) 261]. Sections 3002 and 3003 require EPA to establish standards for generators and transporters of hazardous waste, including tracking of shipments, labeling, containerizing, and ensuring the waste is delivered only to a properly permitted treatment, storage, and disposal facility (TSDF) (40 CFR 262 and 263). Sections 3004 and 3005 require EPA to establish standards for the design, construction, operation, and permitting of TSDFs (40 CFR 264, 265, and 270). Section 3006 requires a process for states to receive authorization to implement and enforce state hazardous waste programs in lieu of the federal program. Section 3010 requires any person engaging in activities subject to Subtitle C to notify the EPA or authorized state of such activity.

C. CONSTITUENTS OF CONCERN

Constituents of concern are not specifically defined in the RCRA statute or the RCRA regulations; however, the concept is the underpinning of EPA's regulatory framework for the management of hazardous wastes. Constituents of concern, for example, are used as the basis for listing particular wastes as hazardous and for establishing the treatment standards under the land disposal restriction (LDR) provisions. Identifying constituents of concern is the first step in determining if a waste should be listed as hazardous under the RCRA program and in defining subsequent requirements for management of that waste. EPA's list of hazardous constituents may be found in 40 CFR 261, Appendix VIII.

The EPA can add hazardous constituents to Appendix VIII when, after investigation, it finds a compound has adverse effects [see 59 Federal Register (FR) 467, January 4, 1994, "Identification and Listing of Hazardous Wastes: Wastes from Wood Surfacing Protection; Final Rule"]. Substances "shown in scientific studies to have toxic, carcinogenic, mutagenic or teratogenic effects on humans or other life forms" may be placed in Appendix VIII [40 CFR 261.11(a)(xi)].

In determining whether a waste generated by a particular process or within a specific industry should be listed as hazardous, EPA will examine the 11 factors enumerated in 40 CFR 261.11(a)(3). One of the primary factors is the presence of Appendix VIII constituents in the waste. After determining that a waste should be listed as hazardous, EPA will support the listing by including in Appendix VII of Part 261, the Appendix VIII constituents that led to that listing.

Constituents for which wastes are listed are also used by EPA to develop treatment standards for the RCRA LDR program. EPA will typically examine all the constituents for which a specific waste is listed (as included in Appendix VII) and develop numerical concentrations in the waste, or in an extract of the waste, that must be met before land disposal of that waste.

The EPA also uses the concept of constituents of concern in other applications, such as in evaluating petitions (40 CFR 260.20 and 260.22) for delisting specific listed wastes. RCRA Section 3001(f) requires EPA, as part of its delisting evaluation, to consider specific factors, including constituents for which the waste was listed. However, even if a compound is not listed in Appendices VII or VIII of Part 261, a compound can be included as one of the factors to be considered in a delisting evaluation [60 FR 31116, June 13, 1995, "Identification and Listing of Hazardous Waste: Final Exclusion for Wastes Generated by a Treatment Process at DOE (Department of Energy), Hanford"].

D. HAZARDOUS WASTE IDENTIFICATION AND LISTING

At the most basic level, a waste is a hazardous waste if it is not excluded from regulation and it is a "solid waste" (as defined in 40 CFR 261.2) and it:

1. Exhibits any of four hazardous characteristics: ignitability (40 CFR 261.21), corrosivity (40 CFR 261.22), reactivity (40 CFR 261.23), or toxicity (40 CFR 261.24);
2. Is specifically listed in Subpart D of Part 261 as a waste from nonspecific sources (40 CFR 261.31), a waste from specific sources (40 CFR 261.32), an acutely hazardous waste [40 CFR 261.33(e)], or a toxic waste [40 CFR 261.33(f)]; or
3. Is a mixture of a listed waste and a nonhazardous waste [except if the listed waste was listed solely because it exhibits one or more of the hazardous characteristics and the resultant mixture no longer exhibits any characteristic, or the mixture is specifically exempted in 40 CFR 261.3(a)(2)(iv), e.g., a wastewater mixture which is subject to regulation under the Clean Water Act (CWA)].

In addition to the above, generators may choose to manage nonhazardous wastes as if they are hazardous wastes (e.g., send the waste to a TSDF for further management). Such wastes, although they may be managed as hazardous waste, are not considered regulated hazardous waste.

Subpart B of 40 CFR Part 261 sets forth the criteria for identifying the characteristics of hazardous waste and for listing hazardous wastes. Characteristics and listings are summarized below.

1. Characteristics

Under 40 CFR 261.10, EPA identifies and defines a characteristic of hazardous waste by determining that the characteristic would cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when it is improperly treated, stored, transported, disposed of, or otherwise managed. The characteristic must be measurable by an available standardized test method that is reasonably within the capability of generators or private sector laboratories or is reasonably detected by generators through knowledge of their waste generation processes.

Presently, there are four RCRA characteristics, which can be summarized as follows:

- *An ignitable waste* is any waste that (1) is a liquid, other than an aqueous solution containing less than 24% alcohol by volume, and has a flash point less than 60°C or 140°F as determined by various test methods; (2) is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or other spontaneous chemical changes and when ignited, burns so vigorously and persistently that it creates a hazard; (3) is an ignitable compressed gas; or (4) is an oxidizer as defined in Department of Transportation (DOT) regulations.
- *A corrosive waste* is any waste that is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5 or is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 in.) per year at a test temperature of 55°C (130°F).
- *A reactive waste* is a waste that is normally unstable and readily undergoes violent change without detonating; reacts violently with water; forms potentially explosive mixtures with water; when mixed with water or, when it is a cyanide- or sulfide-bearing waste that, when exposed to pH conditions between 2.0 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment; is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; is readily capable of detonation or explosive decomposition or reaction at a standard temperature and pressure; or is a forbidden explosive as defined in DOT regulations.
- *A toxic waste* is a waste that contains a threshold concentration of certain listed toxic contaminants (including organic and inorganic contaminants) when tested using the toxicity characteristic leaching procedure (TCLP) leaching test methodology.

2. Listings

Under 40 CFR 261.11, EPA may list a solid waste as hazardous upon determining that the waste:

- Exhibits any of the characteristics of hazardous waste;
- Has been found to be fatal to humans in low doses, or in the absence of data on human toxicity, it has been shown in studies to have an oral LD₅₀ toxicity (rat) of less than 50 milligrams per kilogram (mg/kg), an inhalation LC₅₀ toxicity (rat) of less than 2 milligrams per liter (mg/L), or a dermal LD₅₀ toxicity (rabbit) of less than 200 mg/kg, or is otherwise capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible, illness [acute hazardous wastes under 40 CFR 261.33(e)]; or
- Contains any of the toxic constituents listed in Appendix VIII, and, after considering factors for potential harm, EPA concludes that the waste is capable of posing a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed [toxic wastes under 40 CFR 261.33(f)].

The basis for listing specific toxic wastes focuses on identifying the waste constituents (Appendix VIII) of concern, and demonstrating that they are present in significant concentrations. EPA then determines if the constituents would migrate, persist in the environment, and reach environmental receptors so as to cause a substantial hazard if the waste were managed improperly. In determining the consequences of improper management, EPA typically considers actual damage incidents involving the waste or waste constituents, or situations that would plausibly occur with regard to the waste at issue.

Wastes are listed in Subpart D of 40 CFR Part 261 in various categories. In listing wastes from specific and nonspecific sources (40 CFR 261.31 and 261.32; "F" and "K" coded wastes, respectively), EPA applies the general basis for listing wastes and identifies the waste generation process. The acutely hazardous and toxic chemicals listed under 40 CFR 261.33(e) and (f) ("P" and "U" coded wastes, respectively) are hazardous waste when they are discarded as a pure, commercially marketed chemical, not in a mixture. Any off-specification commercial chemical products, the spill residue from cleanup of the listed commercial chemical product, and container residues of the commercial chemical product are also listed wastes under 40 CFR 261.33(e) and (f).

Once a waste is listed in Subpart D of 40 CFR Part 261, it is hazardous regardless of whether it exhibits one of the four hazardous characteristics. In addition, under the "mixture rule," mixtures of solid waste and listed hazardous waste are considered listed hazardous wastes, unless the mixture has been delisted under 40 CFR 261.3(a)(2)(iv) or the listed waste was listed solely because it exhibits one or more of the hazardous characteristics and the resultant mixture no longer exhibits any characteristic [40 CFR 261.3(a)(2)(iii)].

Further, under the "derived-from" rule, solid waste generated from the treatment, storage, or disposal of a listed hazardous waste, including any sludge, spill residue, ash, emission control dust, or leachate, remains a listed hazardous waste unless it is delisted [40 CFR 261.3(c)(2)(I) and (d)(2)].

The mixture and derived-from rules were challenged shortly after their promulgation in 1980, and on December 6, 1991, the D.C. Circuit Court of Appeals vacated the rules on the basis of a finding that the EPA proposed rulemaking did not adequately provide notice of either rule, and, therefore, the petitioners did not have sufficient opportunity to comment [*Shell Oil Co. vs. EPA*, 950 F.2d 741 (D.C.Cir, 1991)]. The court suggested that the EPA reinstate these rules on an interim basis pending full notice and comment. On March 3, 1992, the EPA published its interim final rule to reestablish the mixture rule and derived-from rule (57 FR 7628). To date, these rules remain in effect.

Another precept affecting the characterization of solid wastes is the "contained-in" principle. The "contained-in" principle was an interpretive principle for the mixture and derived-from rules, which declared that environmental media, such as soil and groundwater, that have been contaminated with a listed hazardous waste must be managed as hazardous waste until the media no longer contain the hazardous waste. The "contained-in" principle is not found in the hazardous waste definition or characterization regulations (40 CFR Part 261); however, the principle was upheld as a reasonable interpretation of the mixture and derived-from rules in *Chemical Waste Management, Inc. v.s. U.S. EPA* [869 F.2d 1526, (D.C.Cir. 1989)]. Also, in the hazardous debris rule (discussed below), EPA formally codified the contained-in principle [see 40 CFR 268.45(a) and 261.3(e)(2)]. As a result, debris that no longer contains a listed hazardous waste would not be subject to Subtitle C regulation, provided that it does not exhibit a RCRA characteristic. Under 40 CFR 268.45 (c), once an extraction or destruction technology is applied, the debris is automatically excluded from regulation provided that it does not exhibit a hazardous characteristic.

As referred to above, listed hazardous wastes can be "delisted" with approval of EPA or the authorized state. The petitioner must demonstrate that the waste produced by the particular generating facility does not meet any of the

criteria under which the waste was originally listed [40 CFR 260.22(a)(1)]. Such procedures and proof may also be used to petition for exclusion of waste mixed with or derived from the treatment of listed wastes.

E. Land Disposal Restrictions

Once a waste has been determined to be hazardous, it must be disposed of in accordance with RCRA LDR regulations. The Hazardous and Solid Waste Amendments (HSWA) to RCRA, enacted on November 8, 1984, prohibit land disposal of untreated hazardous waste [RCRA Section 3004(d), (e), and (g)(5)]. Once a hazardous waste is prohibited from land disposal, the statute provides only two options:

- Comply with a specified treatment standard prior to land disposal; or
- Dispose of the waste in a unit that has been found to satisfy the statutory no migration test [RCRA Section 3004(m)].

Storage of waste prohibited from land disposal is also prohibited, unless the storage is solely for the purpose of accumulating the quantities of hazardous waste that are necessary to facilitate proper recovery, treatment, or disposal [RCRA Section 3004(j)]. Exceptions to the storage prohibition do exist, however. [See also the discussion in this Preamble section under Military Munitions Rule (Subsection F)].

Congress directed EPA to establish treatment standards for all hazardous wastes restricted from land disposal at the same time as the land disposal prohibitions take effect. According to the statute, treatment standards must substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short- and long-term threats to human health or the environment are minimized [RCRA Section 3004(m)(1)]. Treatment standards that meet this criterion are considered to be the best demonstrated available technology (BDAT). The courts have upheld that Section 3004(m) allows both technology- and risk-based treatment standards, provided that technology-based standards are not established "beyond the point at which there is not a 'threat' to human health or the environment" [*Hazardous Waste Treatment Council v. EPA*, 886 F.2d 355 (D.C.Cir. 1989), cert. denied 111 S.Ct. 139 (1990)].

Congress also established a schedule for promulgation of LDRs for all hazardous wastes listed and identified as of November 8, 1984, so that treatment

standards would be in effect, and land disposal of all hazardous waste that did not comply with the standards would be prohibited, by May 8, 1990 [RCRA Section 3004(g)]. LDRs apply to hazardous wastes when they are first generated. Hazardous waste that have been treated to meet the applicable treatment standard may be disposed of in land disposal facilities that meet the requirements of RCRA Subtitle C [RCRA Section 3004(m)(2)].

To meet Congress' schedule, the EPA divided regulated hazardous wastes into three categories called the "first-third," "second-third," and "third-third" wastes, and a schedule for establishing treatment standards was set. The final rule for the "first-third" wastes was issued on August 17, 1988 (53 FR 31138). The final rule for the second-third wastes was issued on June 23, 1989 (54 FR 26594), and the third-third final rule was issued on June 1, 1990 (55 FR 22520). This finalized the treatment standards for all listed and characteristic wastes other than those that were identified as hazardous by EPA after November 8, 1984 (newly identified wastes).

For each listed waste, then, EPA established as part of the LDR program a concentration limit or a treatment technology for each hazardous constituent identified for that waste code. The generator is required to treat the waste to meet the standards for each hazardous constituent of the listed waste, and the treated wastes can then be land disposed of in a Subtitle C hazardous waste unit.

Under the EPA program, LDR treatment standards can be either technology-based or concentration-based, both of which are based on an evaluation of BDAT. The concentration-based treatment standards are based on the concentrations of hazardous constituents in the treatment residuals following treatment with the BDAT. For organic constituents contained in wastewaters and nonwastewaters, EPA based the concentration-based treatment standards on performance data for that compound or for a similar constituent in the same "treatability class." The standards for organics in wastewaters are based primarily on residue concentrations resulting from conventional wastewater treatment technologies. The treatment standards for organics in nonwastewaters are generally based on a BDAT of incineration.

Since June 1, 1990, several court cases and other actions have affected the LDR program. Of particular note are the "deactivation" treatment standards for ignitable and corrosive characteristic wastes that were established in the Third-Third final rule. On September 25, 1992, the U.S. Court of Appeals for the District of Columbia vacated the deactivation standard and ruled that characteristic wastes must be treated to minimize the threat to human health and the environment, as required by Section 3004(m)(1) [*Chemical Waste Management, Inc. et al. v. EPA* (976 F.2d 2 (D.C.Cir 1992) cert. denied 113 S.Ct. 1961 (1993))].

Partly in response to this ruling, and to establish LDR standards for newly identified waste, subsequent phases of the LDR program were planned by EPA, specifically Phases I through IV. The Phase I final rule was promulgated on August 18, 1992 (57 FR 37194). In addition to establishing standards for several types of newly listed identified waste, Phase I finalized alternative (in most cases, less stringent) treatment standards for hazardous debris. Hazardous debris is any solid material exceeding a 60-mm particle size that is intended for disposal and that contains a listed hazardous waste, or which exhibits a hazardous waste characteristic. Debris can be a manufactured object, plant or animal matter, or natural geologic material. Hazardous debris must be treated before land disposal unless the debris no longer contains (per the contained-in policy, discussed above) hazardous waste (40 CFR 268.45). Hazardous debris must be treated by one of the specified technologies for each contaminant subject to treatment. These technologies include extraction, destruction, and immobilization. Hazardous debris that has been treated using one of the specified extraction or destruction technologies in Table 1 of 40 CFR 268.45 and that does not exhibit a hazardous waste characteristic is no longer considered a hazardous waste and may be reused, returned to the natural environment, or disposed of in a Subtitle D landfill. Hazardous debris contaminated with a listed waste that is treated by an immobilization technology is still considered a hazardous waste and must be managed in a RCRA Subtitle C landfill.

On September 19, 1994, the Phase II LDR rule was issued (59 FR 47982). Among other actions, this rule established "universal treatment standards" (UTS) for almost all characteristic and listed wastes that had constituents with concentration-based treatment standards (40 CFR 268.42). The UTS also minimized or eliminated previous confusion by making the concentration-based standard for hazardous constituents of concern uniform regardless of the source or code assigned to the waste. With some exceptions, UTS were established for all previously regulated organic and metal/inorganic constituents.

Before issuance of the Phase II rule, if a characteristic waste was treated to the point that it no longer exhibited the characteristic (i.e., deactivation), it was no longer considered a RCRA hazardous waste. However, the Phase II LDR rule required certain characteristic wastes to be treated for "underlying hazardous constituents" as well. Underlying hazardous constituents are hazardous constituents other than those that caused the waste to exhibit the characteristic, which can reasonably be expected to be present at the point of generation at a concentration above the constituent-specific UTS [40 CFR 268.2(l)]. In accordance with the Phase II rule, underlying hazardous constituents that are reasonably expected to be present in certain characteristic wastes must meet LDR standards as well.

On March 2, 1995, EPA proposed the Phase III LDR rule to address the holdings and reasoning of the D.C. Circuit Court in *CWM vs. EPA*, specifically, dealing with certain types of characteristic wastes that are deactivated through dilution and treated in surface impoundments (60 FR 11702). The Phase III rule was intended to implement the court's ruling to require hazardous constituents in characteristic wastes to be treated so that the constituents were removed, destroyed, or immobilized before the wastes were permanently land disposed. This requirement extended to wastewaters managed in Clean Water Act (CWA) or CWA-equivalent treatment systems and injected into Class I nonhazardous injection wells regulated under the Safe Drinking Water Act (SDWA). The Phase III rule proposed treatment standards that can be met at or prior to the point of discharge (also referred to as "end of pipe"). EPA issued the final Phase III rule on April 8, 1996 (61 FR 15566 and 15660).

However, on March 26, 1996, President Clinton signed the Land Disposal Program Flexibility Act of 1996 (Public Law 104-119, 100 Stat. 830), which overruled the D.C. Circuit Court's opinion, and thus overruled EPA's rules implementing the opinion. A main reason for this legislation was to reinstate the approach for decharacterized wastewaters that EPA adopted in the Third-Third final LDR rule. Subsequently, and as part of the Phase III final rule, EPA withdrew portions of its existing rules that were inconsistent with the new statute.

The Phase IV LDR rule was finalized by EPA in two parts, the first appearing on May 12, 1997 (62 FR 25997), and the second on May 26, 1998 (63 FR 28555). Both parts of Phase IV included standards for additional categories of newly identified wastes. In addition, the first part included provisions designed to significantly reduce LDR program paperwork requirements, added a new LDR technology for a specific category of ignitable characteristic wastes, included clarifications regarding certain exceptions from LDR requirements, and also excluded several types of materials from RCRA regulation, including processed circuit boards and scrap metal. The second part of Phase IV included specific LDR standards for metal-bearing wastes, including toxicity characteristic metal waste and hazardous waste from mineral processing. It also addressed other provisions dealing with mineral processing wastes. Most significant, the second part of the Phase IV rule included reduced requirements for treatment of soil contaminated with hazardous waste.

With issuance of the LDR Phase IV final rules, EPA has addressed all hazardous wastes that were identified or listed before HSWA was enacted, as well as newly identified wastes, and has addressed most of the LDR issues stemming from the Chemical Waste Management law suit and other law suits. Future LDR rulemakings can be expected, however. The intent of these other rulemakings

would be to streamline the LDR program, establish standards for additional wastes identified as hazardous, and address other issues that may arise.

F. MILITARY MUNITIONS RULE

The Military Munitions Rule was proposed by EPA on November 8, 1995 (60 FR 56467) and finalized on February 12, 1997 (62 FR 6621). These regulations were mandated by Section 107 of the Federal Facility Compliance Act (FFCA) of 1992. That section amended RCRA by adding a new Section 3004(y) that required EPA to propose regulations, after consultation with the Department of Defense (DOD) and appropriate state officials, that identify when conventional and chemical military munitions become hazardous waste under RCRA and that provide for the safe storage and transportation of such wastes.

The final rule clarifies application of the regulatory definition of solid waste as it applies to three specific categories of military munitions: (1) unused munitions; (2) munitions being used for their intended purpose, and (3) used or fired munitions. Unused munitions are considered to be solid waste for regulatory purposes when the unused munition:

- Is abandoned by being disposed of, burned, incinerated, or treated prior to disposal;
- Is removed from storage for the purposes of disposal or treatment prior to disposal;
- Is deteriorated, leaking or damaged to the point that it can no longer be put back into serviceable condition, and cannot be reasonably recycled or used for other purposes; or
- Is determined by an authorized military official to be a solid waste.

A munition is not solid wastes for regulatory purposes when it:

- Is being used for its intended purpose, including when it is used for training purposes, for research, development, testing and evaluation purposes, or when it is destroyed during range clearance operations at active and inactive ranges; and
- Has not been used or discharged, including components thereof, and is repaired, reused, recycled, reclaimed, disassembled,

reconfigured, or otherwise subject to materials recovery activities.

The rule also specifies that used or fired munitions are solid wastes when they are removed from their landing spot and then either managed off-range (i.e., transported, stored, reclaimed, treated or disposed of), or disposed of on-range (i.e., buried or landfilled). In both these cases, the used or fired munition is potentially subject to regulation as a hazardous waste. Also, munitions that land off-range and that are not promptly retrieved are considered to be solid waste as defined by the RCRA statute. However, the rule defers final action on the status of used or fired munitions, or residues, at closed, transferred or transferring ranges, to the military's Range Rule (described in the next subsection).

In addition to the above, the final rule provides conditional exemptions from specific RCRA requirements in two cases. First, the rule conditionally exempts from RCRA manifest and container marking requirements waste nonchemical military munitions that are shipped from one military owned or operated TSDF to another in accordance with DOD military munitions shipping controls. Second, waste nonchemical military munitions subject to DOD Explosive Safety Board storage standards are conditionally exempt from RCRA storage requirements. Waste chemical munitions are not eligible for these conditional exemptions. The rule does clarify, however, that chemical munitions are not subject to the LDR storage prohibition established in RCRA Section 3004(j).

DSHW notes that, to date, it has not adopted EPA's military munitions rule, but plans to do so in the near future.

G. RANGE RULE

As indicated above, EPA's final military munitions rule deferred action on the status of used or fired munitions (or residues) at closed, transferred, or transferring ranges to the military's Range Rule. DOD has developed a proposed Range Rule to address the management of military munitions on these categories of ranges. This rule was proposed under 32 CFR 178 on September 26, 1997. To date, the Range Rule has not been finalized. The proposed rule identified a process for evaluating appropriate response actions at closed, transferred, or transferring military ranges. The process consists of two parts consistent with the Comprehensive Response, Compensation and Liability Act (CERCLA) and tailored to the special risks posed by military munitions and military ranges. The rule includes (1) an identification stage, which closed, transferred, or transferring ranges are identified; (2) an assessment phase, when site-specific presumptive responses are implemented; (3) a more

detailed, site-specific range evaluation phase if the site-specific presumptive response is insufficient; and (4) a system for recurrent reviews.

DSHW provided comments to the military on the proposed range rule and intends to evaluate the final rule before adoption.

H. HAZARDOUS WASTE IDENTIFICATION RULE – PROCESS WASTE

On December 21, 1995, the EPA proposed the Hazardous Waste Identification Rule (HWIR) for process waste (60 FR 66344). This proposed rule would allow listed hazardous wastes to exit the RCRA Subtitle C regulatory framework if such listed wastes have concentration "exit levels" below those established for 367 hazardous constituents. Once the waste is exempted it is not hazardous waste, but solid waste, and can be managed in accordance with state-implemented RCRA Subtitle D provisions. The exit levels would apply to all listed wastes (including waste mixed with or derived-from listed wastes), regardless of origin. The exemption would be self-implementing once notification and certification had been made to EPA and a public notice had been issued.

The exit levels proposed for the majority of the constituents are based on a multipathway risk assessment that evaluated potential exposure pathways, both direct and indirect, from a variety of Subtitle D solid waste management units. The remaining exit levels are based on either extrapolation methodology or exemption quantitation criteria (EQC). The risk assessment entailed six components: constituents; toxicity benchmarks; receptors; exposure; fate and transport; and waste management units. EPA developed the initial list of exit level constituents by evaluating Appendix VII to 40 CFR Part 261, "Basis for Listing Hazardous Waste;" Appendix VIII to Part 261, "Hazardous Constituents," and Appendix IX to 40 CFR Part 264, "Groundwater Monitoring List." The EPA narrowed the initial list by eliminating constituents that are reactive in air or water; undergo hydrolysis in soil or water; are part of a chemical class with a specific constituent already represented on the list; or meet other specific removal criteria. Even if exempted under this rule, wastes may still be subject to the LDR requirements. For example, if a waste does not meet the exit levels as generated, but meets them at some point after generation, it would be required to meet the LDR requirements upon disposal, even though it would be exempted from all other RCRA hazardous waste management requirements at the point where the waste first meets the exit level concentrations.

The proposed HWIR rule was very complex and also controversial. EPA received numerous comments from the regulated community, including the State of Utah. While most commenters agreed with the concept of an exit level, many

commenters were critical of the manner in which exit levels were determined. The risk assessment models have drawn criticism from environmental interest groups, industry groups, and EPA's own Science Advisory Board (SAB).

EPA has indicated that it expects to repropose the HWIR – Waste rule by October 31, 1999, and finalize it by April 30, 2001. DSHW expects that the final HWIR will include significantly different language than that presented in the originally proposed version. However, the general rationale and approach of the HWIR (i.e., exemption of low-risk waste streams as determined by a health risk evaluation) is incorporated into the philosophy and approach discussed in today's proposed rule.

I. HAZARDOUS WASTE IDENTIFICATION RULE – MEDIA

The Hazardous Waste Identification Rule – Media was proposed by EPA on April 29, 1996 (61 FR 18779). These regulations were proposed under general RCRA authority and to comply with the President's regulatory reform initiative. Hazardous contaminated media are media that contain hazardous listed wastes or that exhibit one or more of the RCRA characteristics, unless the authorized state or the EPA has determined that the media do not contain hazardous wastes. The intent of the proposed rule was to "formally recognize the differences between as-generated [process] waste and contaminated media, by creating a framework that: (1) allows State and Federal regulators to impose site-specific management requirements on lower-risk contaminated media, and (2) modifies LDR treatment and other requirements that are applicable to higher-risk contaminated media" (61 FR 18782).

The HWIR – Media rule was finalized by EPA on November 30, 1998 (63 FR 65873). It was significantly different from the proposed rule in many respects. First, reduced requirements for management of contaminated soils were established in the LDR Phase IV final rule, referred to earlier. The rule establishes revised definitions for remediation waste and corrective action management units (CAMUs), and a new definition for remediation waste management sites. Further, the rule establishes a new type of remediation waste management unit, called a staging pile, and it also establishes a streamlined permitting process for corrective action remedial action plans. In addition, the rule allows use of alternative cleanup authorities at remediation waste sites.

DSHW intends to evaluate the final rule before adoption.

VI. SUMMARY OF PROPOSED UTAH CHEMICAL AGENT RULE

The proposed Utah Chemical Agent Rule (UCAR) has three basic components: relistings, land disposal restrictions (LDRs), and exemptions. These components are summarized below, followed by discussion of a proposed small-quantity exemption process, the decision-making process that is the basis for the rule, analytical methods that will be used to support compliance with the rule, and rule implementation. The purpose and applicability of the rule are reviewed first.

A. PURPOSE

As previously indicated, the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has regulated chemical agents and associated wastes as hazardous wastes since July 1, 1988. Chemical agents and associated wastes were not then and are not now listed by the U.S. Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act (RCRA). Hence, these wastes, while classed as hazardous within the State of Utah, are not hazardous wastes under the RCRA program, and for the most part (unless they exhibit a RCRA characteristic) are not subject to the LDR program. The primary purpose for proposing the UCAR is to establish LDRs for chemical agents and associated wastes in Utah.

The state's waste listings are proposed to be reorganized into specific listing categories on the basis of physical and chemical characteristics of the wastes to facilitate establishment of LDRs and to more closely reflect EPA's system for waste listings. In addition, in the process of establishing listing categories and LDR standards, DSHW has chosen to take a critical look at the regulated chemicals and has proposed to expand overall coverage.

Finally, DSHW expects that LDR treatment will, in many cases, reduce hazardous constituent concentrations in listed wastes (treatment residues) to below levels of concern. Hence, DSHW is also proposing to incorporate exemptions for wastes that do not contain hazardous constituents above levels of concern into today's proposed rule.

The overall benefit of the UCAR is that chemical agents and associated wastes will be treated to levels considered more protective for land disposal and will be more effectively and efficiently managed.

B. APPLICABILITY

The UCAR, when final, will apply to generators, transporters, treaters, and disposers of the wastes proposed to be listed, where such generation, transportation, treatment, or disposal occurs within the State of Utah. The rule would not apply if, and at the point where, the listed wastes were transported out of state for treatment, storage, or disposal. Wastes transported out of state are subject to the rules effective in the receiving state. If the listed wastes described herein are transported into the State of Utah for any reason, the UCAR, when final, would apply to those wastes immediately upon their arrival in the state.

Nothing in today's proposed rule is intended to limit generators or treaters from sending chemical agent associated waste off-site, either within the state or out of state, for treatment or disposal. The Army's own regulations, as described in Section III of this Preamble, prohibit the Army from sending chemical agents, such as may be contained in munitions or in storage containers, to commercial facilities for any reason. However, the Army generates a number of secondary waste streams, primarily from treatment of wastes to remove or destroy chemical agent, that may contain minute amounts of the agents or associated compounds. This proposed rule would provide assurance that such wastes that are sent to commercial hazardous waste management facilities for further treatment or disposal are properly managed.

C. HAZARDOUS WASTE RELISTINGS

As indicated in Section IV of this Preamble, the State of Utah finalized a rule in July 1988 that listed specific chemical agents under the P999 listing and residues from demilitarization, treatment, and testing of P999 wastes under the F999 listing. Typically, hazardous waste management standards (such as LDR treatment standards) are developed for like classes or categories of waste streams. Waste management standards are thus tailored to the physical and chemical characteristics of the wastes in the category. The 1988 chemical agent waste listings, however, lumped all the agents and associated waste streams under the two generic waste categories. Hence, the first component of today's proposed rule is to establish more specific listing categories for agent associated waste streams. This proposed rule would remove the P999 and F999 listings added in July 1988 and replace them with more specific listings, as summarized below. These specific listings are needed to support the proposed LDRs and the exemptions also proposed in today's rule.

1. Chemicals of Concern

a. General

The proposed UCAR focuses on chemical agents and associated waste streams. The key basis for listing such waste streams as hazardous waste is the determination of what specific chemicals are or may be present in these waste streams that may pose a hazard to human health and the environment. More detailed information on the chemicals of concern is provided in Section VII of this Preamble; a summary is provided below.

b. Commercial Chemical Products

The term "commercial chemical product...refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient" [40 CFR 261.33(d)(Comment)]. Chemicals that are not "manufactured or formulated for commercial or manufacturing use" would not be identified as commercial chemical products. This concept is important because many pollutants formed in wastes, or formed during waste treatment, are identified as hazardous waste constituents but are not commercial chemical products.

Commercial chemical products are identified under the hazardous waste regulations to ensure that chemicals that are discarded or intended to be discarded (and that therefore become waste), for whatever reason (e.g., chemical has exceeded its shelf life, chemical is no longer needed), are regulated as hazardous waste. DSHW's 1988 final rule identified specific chemical agents as commercial chemical products under the generic waste code of P999. DSHW now proposes to replace the "999" designation with chemical-specific codes (e.g., P901, U901, etc.). DSHW also proposes to remove selected chemicals from the P999 category and to add others under specific "P" and "U" listings.

DSHW also wishes to clarify that, in reality, none of the chemicals proposed to be listed as commercial chemical products within today's rule are commercially available. As indicated in Section III of this Preamble, strict controls are in place to ensure that such chemicals remain under military control. The commercial chemical product listing of the agents is somewhat of a misnomer in this regard; the listing proposed herein merely provides a convenient mechanism to ensure that military chemical agents (e.g., as contained in munitions or ton containers), when discarded or intended to be discarded, are regulated as hazardous waste.

c. Hazardous Constituents

DSHW will propose substances as "hazardous constituents" if they have been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms. The primary purpose of identifying hazardous constituents in DSHW's hazardous waste regulations is to support the hazardous waste listings. If DSHW finds that a waste stream typically contains at significant concentrations chemicals that are proposed to be listed as hazardous constituents, it has proposed to list such waste as hazardous waste.

While hazardous constituents that are identified for a particular waste stream will include the parent agent associated with the waste stream (i.e., the commercial chemical product referred to above), hazardous constituents also include pollutants that are formed in wastes or are formed during waste treatment, assuming that they have been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms.

2. Process Wastes

a. General

The term "process wastes," in the context of today's proposed rule, refers primarily to secondary waste streams that are generated from the treatment, storage, or disposal of the chemical agents proposed to be listed under the new commercial chemical product listings ("P" and "U"). Today's proposed rule would remove the 1988 generic F999 listing, and replace it with more specific "K" listings. Additional information on the new proposed "K waste" listings is provided in Section VIII of this Preamble. A summary is provided below.

b. Process Wastes

The proposed process "K" waste listings are intended to facilitate the identification of LDR treatment standards by grouping waste streams on the basis of general physical and chemical characteristics.

c. Basis for Listing

The proposed "K" listing includes waste streams, known or suspected to contain the proposed hazardous constituents in significant concentrations. This concept is the primary basis for listing. The physical and chemical characteristics of the waste stream, such as its ignitability, corrosivity, or reactivity, are also considered in listing decisions.

3. Groundwater Monitoring Constituents

The final component of the listings in today's proposed rule is the identification of proposed groundwater monitoring constituents. Although such constituents may be hazardous, they may also include chemicals that are not toxic at all but that are included because they may be good indicators that a waste or waste components have migrated from a land disposal unit. Groundwater monitoring constituents proposed today are discussed in Section VII of this Preamble.

D. LAND DISPOSAL RESTRICTIONS

After the new waste listing categories are established, the next step is to develop the LDRs — the second major component of today's proposed rule. Once a waste has been determined to be hazardous, it must be disposed of in accordance with the LDR regulations. Specifically, wastes must be treated to comply with specified treatment standards before land disposal. These treatment standards are intended to diminish the toxicity of the waste or reduce the likelihood of migration of hazardous constituents from the waste.

Two basic types of LDR treatment standards exist: technology based and concentration based. Where a technology-based standard applies, wastes must be treated by that technology. Where a concentration-based standard applies, wastes must be treated to meet the concentrations established for individual constituents. The primary advantage of the technology-based standard is that wastes do not need to be analyzed to prove that treatment standards have been met; the primary advantage of the concentration-based standard is that the facility has the flexibility to determine the most appropriate technology to use in treating the waste, including emerging and innovative technologies.

An innovative approach has been established with respect to these standards in today's proposed rule. Specifically, both technology- and concentration-based LDR standards are proposed for the same listed waste streams. Further, the Army will be permitted the choice of determining, for specific listed wastes, which standard would be applied. While the LDR concentration standards are based directly on risk (i.e., they are developed from application of a human health risk assessment), the identified LDR technologies nevertheless must meet the concentration-based numbers as a condition of their being proposed in today's rule. In this manner, regardless of which option is chosen by the Army for application to a specific waste stream, protection of human health and the environment is ensured. The advantage is that when the technology-based standard is applied, repeated and expensive analyses are

avoided. In addition, the rule would permit use of emerging and innovative technologies, as long as the LDR concentration-based standards are met.

LDR technologies are identified in Section IX of this Preamble. The derivation of the LDR concentration-based standards is detailed in Section XI.

E. EXEMPTIONS FOR LISTED WASTE

Many of the chemical agent associated waste streams, either as generated or as a result of LDR treatment, would no longer be expected to contain significant amounts of the chemical agents (or other hazardous constituents). This situation applies to, as examples, incineration waste streams (e.g., incinerator ash) and chemical neutralization waste streams (e.g., neutralization waste solids). Many of these waste streams would be expected to pose no significant hazard to human health and the environment. DSHW believes that these waste streams can be excluded from control as a hazardous waste without significant adverse effects on human health and the environment. Wastes excluded from Subtitle C control would remain regulated under DSHW's Subtitle D program for nonhazardous wastes. Hence, although excluded from regulation as a hazardous wastes, DSHW would retain oversight over their management and disposition.

DSHW is proposing to incorporate in the UCAR a provision that would relieve certain wastes from hazardous waste control. Specifically, DSHW is proposing to establish health-risk-based exemption levels. These exemption levels would be established by using a risk model similar to that used to develop the LDR concentration-based standards, as discussed above, but would be based on more conservative assumptions regarding potential for exposure. Hence, proposed health-risk-based exemption levels for individual constituents are significantly lower (i.e., more stringent) than the proposed LDR concentration standards for the same constituents.

Exemptions for listed wastes are discussed in Section X. The derivation of the health-risk-based exemption levels is detailed in Section XI.

F. SMALL-QUANTITY EXCLUSION

DSHW recognizes that in some cases, waste streams produced by the Army may be of small quantity and short duration. The combination of waste characteristics and small quantity, coupled with specific engineering or other management controls, may reduce the probability of risk to human health and the environment to negligible levels. DSHW is therefore proposing to incorporate a

small-quantity exclusion provision for specific chemical agent associated waste streams. To qualify for this exclusion, the Army must demonstrate that the level of protectiveness that is reasonably expected to be obtained by alternative controls will functionally meet or exceed those levels intended and prescribed by the provisions of today's proposed rule. Waste streams that are otherwise hazardous (i.e., are federal RCRA listed wastes or exhibit a RCRA characteristic) will not qualify for this exclusion. The small-quantity exclusion is further described in Section VIII.C.6 of today's proposed rule.

G. DECISION-MAKING PROCESS

The conceptual flow of the decision-making process for the proposed rule is shown in Figure VI-I. The flow diagram is based on the premise that all agent associated waste listed as hazardous waste would need to meet LDR standards before land disposal. It illustrates the relationship between the proposed agent waste listings, the LDR standards, and the exemption levels.

Key considerations in the decision-making process are whether wastes would qualify for the exemption, and whether the Army's analytical methods are sufficiently sensitive to detect agent in the waste at the exemption level:

- If the Army can demonstrate through analyses that wastes or treatment residues meet established exemption levels, the waste would be exempted.
- For wastes that do not yet meet LDR requirements, the Army may either decide to apply the LDR treatment technology or treat the waste such that it meets the concentration-based LDR standards.
- Where alternative LDR treatment technologies are employed (including emerging technologies), the LDR concentration-based standards are used to demonstrate compliance.

Waste analyses would only be required:

- If the Army believes that the wastes, either as generated or as a result of LDR treatment, meet exemption levels.
- If an alternative or emerging technology is used to meet LDR concentration-based standards.

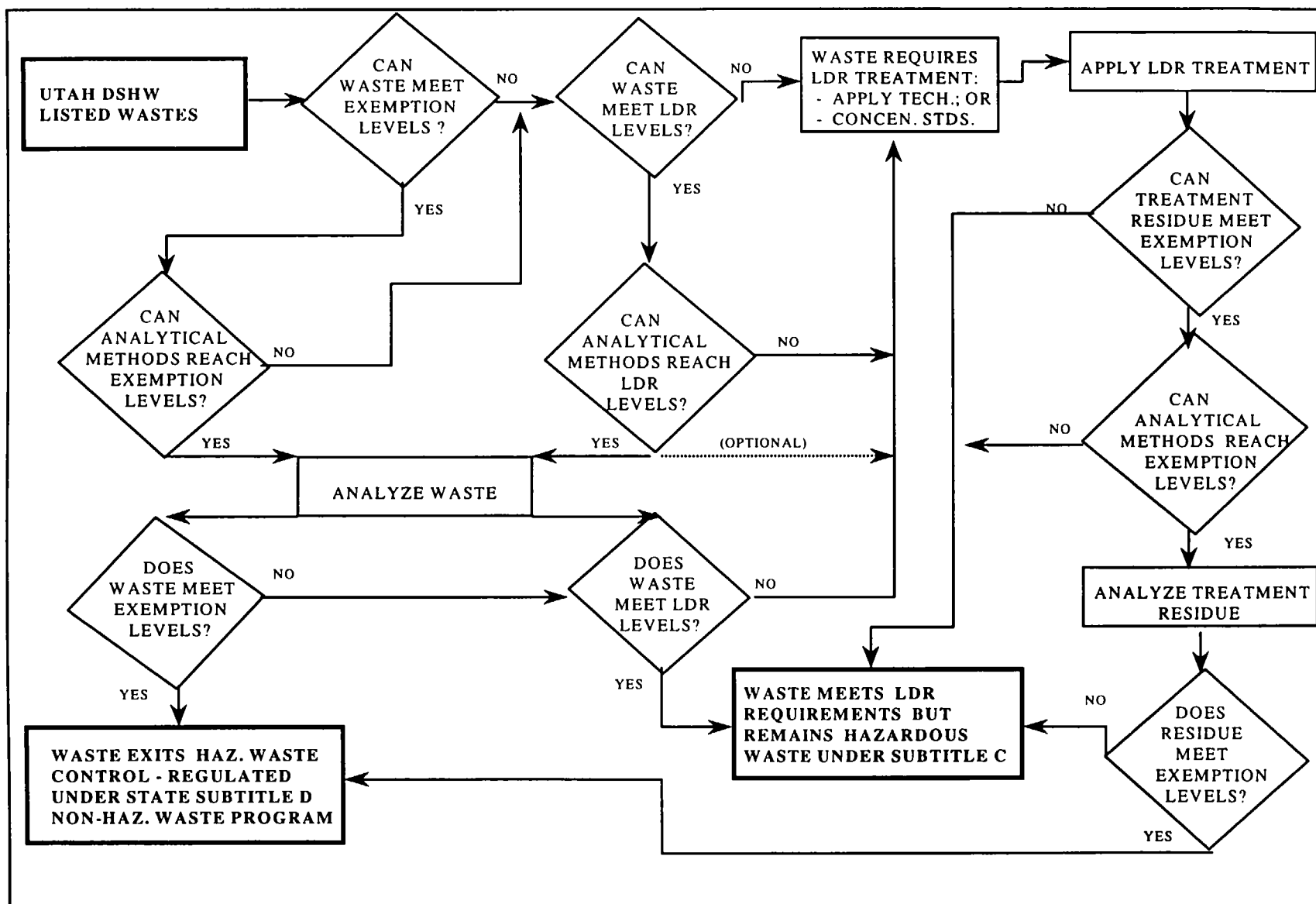


FIGURE VI-1 Proposed Utah Chemical Agent Rule Decision Process

The small-quantity exclusion is also available if the Army can demonstrate that small volume, coupled with waste characteristics and specific engineering or other management controls, affords a level of protectiveness that meets or exceeds those provisions described in today's proposed rule.

H. ANALYTICAL METHODS

The analytical methods that will be employed by generators, and treatment, storage, and disposal facilities (TSDFs) to comply with today's proposed rule, when final, are critical. The DSHW has established two objectives for these analytical methods:

1. Methods should be sufficiently sensitive to detect chemicals at or below the action level concentrations (i.e., LDR concentration-based standard or exemption levels).
2. Methods should be sufficiently validated, meaning that the methods should be sufficiently precise, accurate, and reproducible to support decision making.

If the Army does not have analytical methods that meet these criteria for any specific waste stream, the LDR technology-based standard would be applied, and the waste would be ineligible for exemption. This concept is also illustrated in the flow diagram in Figure VI-1. Analytical methods are discussed in Section XII of this preamble.

I. IMPLEMENTATION

The process for implementing today's proposed rule is critical, especially considering that the DSHW's existing regulation (established in 1988) regulates nearly all of the waste streams that would be regulated under today's proposed rule, and that additional waste streams would become newly regulated. In some cases, existing requirements would conflict with requirements that would be established by today's proposed rule. A smooth transition from the old rule to the new rule would be necessary. In addition, DSHW and the regulated community will require time to modify existing permits, permit applications, internal procedures, and other documentation in order to replace conflicting requirements and to ensure compliance with the new rule.

For these reasons, DSHW is proposing that these amendments become effective 9 months from publication of the final rule. Facilities will be required to

submit permit modification requests, or modified permit applications (for new facilities), within 9 months of publication of the final rule. Wastes generated after the effective date of the rule will be required to be categorized according to the new waste codes as identified in the final rule. However, DSHW is proposing that wastes in storage before the effective date of the final rule can remain in storage with the existing waste description up to the time of treatment or disposal. New waste codes must be assigned before such wastes are removed from storage for treatment or disposal. The transition, the effective date, and other elements of the rule's implementation are discussed in more detail in Section XIII of this Preamble.

VII. CHEMICALS OF CONCERN AND PROPOSED CHEMICAL LISTINGS

A. SUMMARY

1. General

The determination of which chemical agents and associated chemicals should be regulated under Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) hazardous waste rules is complex. Furthermore, for those chemical agents and associated chemicals that DSHW proposes for regulation in some capacity, the determination of how those chemicals should be regulated is equally complex.

For guidance in these areas, DSHW has evaluated the U.S. Environmental Protection Agency's (EPA's) policies and procedures. Such review is appropriate because DSHW has adopted most of EPA's hazardous waste regulations established under the Resource Conservation and Recovery Act (RCRA) program. However, DSHW does not intend to duplicate EPA's decision-making process. EPA regulations with respect to chemical identification under the RCRA program apply nationwide. For today's proposed rule, the focus is on one industry in one state. This industry-specific, state-specific outlook provides the opportunity to apply a tailored approach. For example, while EPA regulates treatment and disposal of toxic chemicals under the RCRA program, EPA typically does not evaluate chemicals that are by-products/impurities, intermediates, and breakdown products that may be associated with these chemicals, unless they are already listed under the RCRA regulations. DSHW is concerned about the "associated" chemicals and proposes to regulate them if they are also toxic. This approach of identifying not only the toxic chemical, but also significant by-products/impurities, intermediates, and breakdown products that are also toxic, is more conservative than typical EPA practice.

Section A.2 summarizes the various listing categories. Section A.3 describes other considerations for listing. Section A.4 provides proposed criteria for determining on which list, if any, specific chemical agents and associated chemicals should be placed and identifies proposed chemical listings. DSHW's proposed chemical listings are summarized in Section B. Background Document B discusses these chemicals in detail. Background Document C reviews chemicals that were evaluated for this proposed rule but that are not proposed for regulation in any capacity. Background Document D provides available Material Safety Data Sheets (MSDS) on the chemicals proposed for regulation.

2. Summary of Listing Categories

EPA has listed individual chemicals in a number of categories in its hazardous waste rules under the RCRA program. In this subsection, DSHW summarizes EPA categories as established under the RCRA program, discusses their significance and primary applications, and introduces proposed actions per today's rule.

a. 40 CFR 261, Appendix VIII "Hazardous Constituents," as adopted in R315-2-10

As indicated previously in this Preamble, substances are listed by EPA as Appendix VIII hazardous constituents if they have been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms. The primary purpose of Appendix VIII is to support EPA's listing program, under which if EPA finds that a waste stream typically contains chemicals listed in Appendix VIII at significant concentrations, it will list such wastes as hazardous wastes under 40 CFR 261 Subpart D — "Lists of Hazardous Wastes" [including both wastes from specific and nonspecific sources listed under 40 CFR 261.31 and 261.32, respectively, and commercial chemical product wastes listed under 40 CFR 261.33(e) and (f)]. The presence of an Appendix VIII hazardous constituent in a waste stream, however, does not of itself make that waste stream a hazardous waste.

DSHW's 1988 final rule identified specific chemical agents as commercial chemical products [R315-2-11(e)]. Today's proposed rule would replace this existing listing. DSHW did not, in 1988, identify these chemicals as "hazardous constituents." In today's proposed rulemaking, DSHW proposes to add a number of chemicals to Appendix VIII (as adopted in R315-50-10) that meet the criteria for Appendix VIII listing, as indicated above, and that are chemical agents or significant by-products/impurities, intermediates, and breakdown products associated with chemical agents.

b. 40 CFR 261.33(e) and (f) "Discarded Commercial Chemical Products, Off-Specification Species, Container Residues, and Spill Residues Thereof," as adopted in R315-2-11(e) and (f)

40 CFR 261.33 contains two lists of chemicals, (e) and (f). Chemicals on the (e) list are sometimes referred to as "P" chemicals, because EPA assigned hazardous waste codes that begin with a "P" (e.g., P123) to these chemicals. Chemicals on the (f) list are sometimes referred to as "U" chemicals because EPA assigned them hazardous waste codes that begin with a "U" (e.g., U123). These lists contain chemicals that meet EPA's definition of "commercial chemical product." The term "commercial chemical product...refers to a chemical substance

which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient" [40 CFR 261.33(d)(Comment)].

Chemicals that are not "manufactured or formulated for commercial or manufacturing use" would not be identified as commercial chemical products. This concept is important because many pollutants that are formed in wastes, or formed during waste treatment, are identified as hazardous waste constituents in EPA rules, but are not classed as commercial chemical products. Note that quality assurance and quality control standards for these noncommercial compounds are established for analytical purposes, but this application is not considered reason for identifying a chemical as a commercial chemical product. This distinction is important because by-products/impurities, intermediates, and breakdown products that are proposed for regulation in today's rulemaking fall into the same category.

The difference between EPA's "P" and "U" lists is primarily a function of potency. Chemicals on the "P" list have been shown to be acutely toxic by having a rat oral LD₅₀ (dose lethal to 50% of exposed population) of less than 50 mg/kg, a rat inhalation LC₅₀ (concentration lethal to 50% of exposed population) of less than 2 mg/L, or a rabbit dermal LD₅₀ of less than 200 mg/kg [40 CFR 261.11(a)(2)]. Chemicals on the "U" list are not acutely toxic, but are listed therein because they have been shown in scientific studies to have toxic (but not acutely toxic), carcinogenic, mutagenic, or teratogenic effects on humans or other life forms. EPA developed the lists of chemicals in 261.33(e) and (f) to ensure that chemicals that are discarded or intended to be discarded, for whatever reason (e.g., chemical has exceeded its shelf life or is no longer needed), are regulated as hazardous waste under the RCRA program.

As indicated above, DSHW's 1988 final rule identified specific chemical agents as commercial chemical products [R315-2-10(e)]. A generic waste code of P999 was applied to all the chemicals listed therein. Today's proposed rule would replace this existing listing. In addition, DSHW proposes to replace the "999" designation with chemical-specific codes (e.g., P901, P902, etc.).

In 1988, DSHW did not identify any chemicals in the "U" (toxic, but not acutely toxic) category. According to the Army, however, several of the chemical agents were developed not for their lethal effects, but for their incapacitating effects. For example, some of the agents fall into the category known as sternutators or vomiting compounds, and others were developed as a nervous system depressant or hallucinogen. Today's proposed rule would establish individual "U" listings (e.g., U901, U902, etc.) for these chemicals.

- c. *40 CFR 261.31 "Wastes from Nonspecific Sources and 40 CFR 261.32 "Wastes from Specific Sources," as adopted in R315-2-10(e) and (f)*

As indicated in 40 CFR 261.33(d) (Comment), the listings in 40 CFR 261.33(e) and (f) do "not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f)." EPA further indicates under the 40 CFR 261.33(d) (Comment) that when a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraph (e) or (f), such waste will be listed in either Section 261.31 or 261.32. EPA has therefore listed a number of waste streams under these sections, with wastes from nonspecific sources (generated by more than one industry) being placed in Section 261.31, and wastes from specific sources (generated by one industry, usually by specific processes) going into Section 261.32. These waste streams become hazardous waste when they meet the listing description provided in the regulations. Wastes in the nonspecific sources category (Section 261.31) are assigned "F" hazardous waste codes (e.g., F001, F002), and wastes in the specific sources category (Section 261.32) are assigned "K" hazardous waste codes (e.g., K001, K002).

DSHW's 1988 final rule established a generic F999 waste code for "residues from demilitarization, treatment and testing of nerve, military and chemical agents." DSHW proposes to remove the current F999 listing and the generic "999" designation, and identify specific process waste streams. Given that the "K" listings are used by EPA for wastes from specific sources or industries, and considering that the military is perceived as an industry, DSHW proposes to establish "K" codes for specific agent associated process waste streams. Specific proposed "K" process waste streams are discussed in Section VIII of this Preamble.

- d. *40 CFR 261 Appendix VII, Basis for Listing Hazardous Waste, as adopted in R315-50-9*

To support listing of "F" and "K" wastes, EPA conducts a listing study, which includes examination of waste streams for the presence of Appendix VIII hazardous constituents. If EPA finds that certain waste streams typically contain significant amounts of Appendix VIII hazardous constituents, it will usually propose listing of these waste streams.⁸ EPA established Appendix VII of 40 CFR 261 to serve as a basis for listing. Accordingly, Appendix VII identifies specific hazardous constituents that serve as the "basis for listing" of "F" and "K" waste streams.

⁸ EPA will also examine wastes to determine if they exhibit any of the four RCRA characteristics (40 CFR 216.21-24). EPA may decide not to specifically list waste streams if they typically exhibit one or more RCRA characteristics.

Hence, chemicals listed in Appendix VII should already have been listed in Appendix VIII.⁹

The significance of Appendix VII, as promulgated by EPA, originally was quite limited, because it merely served as a list of hazardous constituents for which each specific and nonspecific waste stream was listed. Appendix VII's primary application was in permitting¹⁰ and delisting¹¹ activities, which both require application of waste-specific information. When EPA began to promulgate land disposal restrictions (LDRs) pursuant to the HSWA of 1984, Appendix VII began to take on more importance as treatment standards were developed by EPA taking into account all the compounds listed in Appendix VII for specific waste streams. LDR treatment standards, found in 40 CFR 268, are adopted in DSHW regulation R315-13.

In the 1988 final chemical agent rule, DSHW included the chemical agents as the basis for listing the F999 hazardous waste listing, and added these to R315-50-9. In today's rule, DSHW is proposing to remove the existing R315-50-9 listing and replace it with a new R315-50-9 listing of hazardous constituents for each of the proposed new "K" listings. Also, and as indicated above, DSHW proposes to add these chemicals to R315-50-10, hazardous constituents (EPA's 40 CFR 261, Appendix VIII).

*e. 40 CFR 264 Appendix IX, Groundwater Monitoring List,
as adopted in R-315-50-14*

EPA has established, in 40 CFR 264 Subpart F, regulations pertaining to "Releases from Solid Waste Management Units." These regulations, which DSHW has adopted (R315-8-6, "Groundwater Protection"), establish requirements for groundwater monitoring at RCRA-permitted land disposal facilities. EPA regulations require detection monitoring for specific constituents and indicator parameters; if a statistically significant increase in these parameters over background is observed, the facility is required to implement compliance monitoring. Compliance monitoring entails, among other things, sampling and analysis of the groundwater for 40 CFR

⁹ Although EPA can, and has, established Appendix VIII listings at the same time that it has established "K" listings and listings in Appendix VII.

¹⁰ RCRA permits include constituent-specific information, such as waste analysis plans, that are based in part on the hazardous constituents for which the waste was listed (see 40 CFR 264 and 270).

¹¹ Delisting, described in 40 CFR 260.20 and 260.22, and adopted by DSHW in R315-2-16, is a process whereby a specific waste may be excluded from the definition of hazardous waste (i.e., delisted) if it can be shown that the waste in question is not hazardous.

264, Appendix IX, groundwater monitoring constituents. 40 CFR 264, Appendix IX, adopted in R315-50-14, therefore has significant implications for land disposal facilities. Sampling and analyzing for numerous Appendix IX constituents can be quite expensive. Furthermore, the Appendix IX list of groundwater monitoring constituents is often examined to identify analytes for other environmental media that may be potentially contaminated.

The Army has provided data and information to DSHW indicating that all of the key chemical agents that are proposed for listing in today's rule are degraded (typically through hydrolysis) into other compounds in a hydrolytic environment. Details are provided in Appendix E (Modeling Potential Chemical Agent Contamination of Groundwater) of Background Document E [*Derivation of Health-Based Environmental Screening Levels (HBESLs) for Chemical Warfare Agents*].

Releases of hazardous waste or constituents from land disposal environments (assuming a release does occur) would entail gradual release of constituents into the subsurface, migration through the unsaturated zone to the groundwater, hydraulic transport over some distance, and eventually arrival at a receptor well. This migration process typically takes many years, often decades. In the case of Utah, where groundwater receptors are typically many miles away from Army installations and commercial land disposal facilities, this process may take hundreds of years. At the same time, the agents that are addressed in today's proposed rule readily hydrolyze on contact with water and are extremely likely to be fully degraded long before the contaminant "plume" would reach a downstream receptor. Hence, DSHW is not proposing to add the agents to the regulations adopted in R315-50-14.

DSHW is, however, proposing to add certain agent breakdown products, particularly those that are relatively stable in groundwater, to the list of groundwater monitoring constituents. DSHW has examined data provided by the Army on potential breakdown products and has determined that most breakdown products are relatively nontoxic and do not warrant listing as Appendix VIII hazardous constituents. DSHW is nevertheless proposing that chemicals be added to the list of groundwater monitoring constituents, mostly because they would be good indicators of a release from a land disposal unit that contains chemical agent associated waste.

3. Other Considerations

Significant confusion has arisen in the past as to what chemicals are truly chemical agents as opposed to what are intermediates, impurities, breakdown products, or other compounds altogether. Other examples include "historic" agents developed during World War I that are no longer present, experimental agents that

were evaluated but never deployed, and foreign agents that are simply not present in the United States. Part of the confusion stems from various documents that the Army has developed in the past that list potential chemical agents, along with other compounds, such as foreign agents, and riot control materials. An example of such a document is Army Regulation (AR) 50-6, *Chemical Surety* (Headquarters, Department of the Army, Washington, D.C. February 1, 1995) (DA 1995).

That document was discussed in Preamble Section III. In some cases, for example, documents such as AR 50-6 may be interpreted to place riot control agents (e.g., tear gas) in the same class as lethal chemical agents.¹² This has caused confusion for DSHW in the past. DSHW is not interested in regulating riot control agents. For example, CN (chloroacetophenone), a lacrimator (produces tears) developed after World War I, was formerly used as a riot-control agent; however, it is now considered obsolete for military employment (HQ/DA, DN, AF 1990). CN is the active ingredient of the personal protection agent, "Mace" and, hence, is a commercial chemical used in private industry (and by the general public). Another example is PS (chloropicrin). PS, an irritant similar to CN in its effects, was used during World War I. CN and PS are not currently listed under the RCRA program by EPA, and, hence, they are not currently incorporated into DSHW regulations. Furthermore, DSHW does not wish to propose regulating these chemicals.

Documents such as AR 50-6 identify a number of other chemicals, many of which do not warrant regulation because they have little chance of becoming waste or contaminants in waste. Included, for example, are chemicals that were experimental agents but that were never produced on a large scale, chemical agents produced in foreign countries and not in the United States, binary agents that by themselves are not particularly toxic (but when combined with their appropriate counterparts, become active), intermediates and precursors, and others. Because DSHW is aware of these other documents (and the chemicals listed therein), DSHW has deemed it important not only to identify chemicals that warrant regulation as hazardous constituents under the rule, but also to discuss those that do not, such as CN and PS. Background Document C discusses selected chemicals that have been associated with chemical agents in the past, but that are not currently chemical agents and do not warrant regulation.

¹² The Army does not consider riot control agents; chemical herbicides; smoke and flame producing items; or soil, water, debris or other materials contaminated with chemical agents as being chemical agents.

4. Proposed Criteria and Chemical Listings

The first step that DSHW took in determining what chemicals should be regulated, and how they should be regulated, was to identify criteria for their consistent evaluation. These criteria fall into six general categories. These categories (posed as questions) and relevant criteria are discussed below. Chemicals proposed for regulation are then identified.

(1) What chemicals should be considered for listing?

As indicated above, DSHW finalized a rule in 1988 that listed 14 specific chemical agents as hazardous waste: CX, GA, GB, GD, H, HD, HL, HN1, HN2, HN3, HT, L, T, and VX.¹³ DSHW has since determined that some of these chemicals do not warrant listing under the DSHW hazardous waste regulations. Also, DSHW has learned that other chemicals exist that might be considered chemical agents and that should be listed under the DSHW hazardous waste regulations. Today's rule, therefore, proposes to remove all of DSHW's existing listings for chemical agents and to establish new listings.

As part of the process for identifying chemicals that warrant listing in some capacity, DSHW developed a draft proposed rule and provided it to the Army for review and comment in February 1996. Twenty-eight chemicals were identified in this 1996 proposed rule, as follows: "BZ, CX, PD, ED, MD, DP, VX, G-Series Agents (e.g., GA, GB, GD, GF), Sulfur Mustards (e.g., H, HD, HQ, HL, HT, Q, T), Nitrogen Mustards (e.g., HN1, HN2, HN3), Lewisites (e.g., HL, L, L-1, L-2, L-3), DF, QL, Chlorosarin, Chlorosoman, and S-2." The Army indicated that HL was listed twice, that H and HD were essentially the same chemical,¹⁴ and that L and L-1 were the same chemical. Further, the Army did not know what chemical S-2 was (the listing of S-2 was subsequently determined to be an error on DSHW's part).

The Army committed to providing the DSHW with data and information on these chemicals. During this process, the Army reviewed documents such as AR 50-6 and also evaluated other chemicals that it was aware of that might be considered, not because they were chemical agents per se, but rather because they were either associated with chemical agents (often wrongly), or were agent by-products/impurities, intermediates, and breakdown products.

¹³ See Background Document A for full chemical names and definitions of other abbreviations used in this Preamble.

¹⁴ HD is the distilled form of H.

The "universe" of those chemicals that have been evaluated by DSHW in terms of disposition in today's proposed rule was established as follows:

- Chemicals regulated under DSHW's current rule (R315-2-10 and 11),
- Chemicals listed in the DSHW February 1996 draft proposed rule, and
- Other chemicals, as selected, based on input from the Army.

(2) *Should the chemical be listed in 40 CFR 261.33(e) (adopted in R315-2-11(e)) as an acutely toxic "P" commercial chemical product?*

As indicated above, the "P" list consists of chemicals that are acutely toxic commercial chemical products. EPA has established quantitative criteria for determining if a chemical is acutely toxic under RCRA. The criteria for determining if a chemical should be identified as acutely toxic are as follows:

- Chemical is acutely toxic if it has a rat oral LD₅₀ < 50 mg/kg or rat inhalation LC₅₀ < 2 mg/L or rabbit dermal LD₅₀ < 200 mg/kg (40 CFR 261.11(a)(2)).¹⁵

Although fairly straightforward, the above criteria do require some interpretation. For some chemicals, the above toxicity data exist, and the determination as to whether a chemical is acutely toxic by these criteria is fairly straightforward. For other chemicals, some interpretation is required, which may include extrapolation of data, for example, from mouse LD₅₀ to rat LD₅₀, or from intravenous LD₅₀ to oral LD₅₀.

While EPA has a definition of commercial chemical product [see 40 CFR 261.33 (d)(Comment)], it does not apply to chemical agents.¹⁶ Therefore, the DSHW is proposing the following criteria:

¹⁵ Note that acute toxicity criteria under DSHW's current rules (R-315-2-9(c)(1)(ii)) identify a rat inhalation LC₅₀ of < 50 mg/L. DSHW has opted, however, to defer to EPA's more stringent criteria of < 2 mg/L for today's proposed rule.

¹⁶ Chemical agents are not commercially available; they are strictly controlled by the U.S. Army in accordance with DOD and Army regulations and directives (described in Section III of this Preamble).

- A chemical is a commercial chemical product if it is a chemical agent that is currently contained in stored munitions or is stored in containers (e.g., ton containers) in Utah (i.e., is part of the U.S. chemical stockpile stored in Utah).
- A chemical is a commercial chemical product if it is a chemical agent that is contained in chemical agent identification sets (CAIS).

Chemicals currently contained in stored munitions or that are stored in containers (e.g., ton containers) in Utah are GA, GB, HD, HT, L, and VX. These stockpile chemicals are considered to be the key chemical agents.

The Army developed CAIS during World War II to aid soldiers in identifying chemical attacks. Over 120,000 CAIS were manufactured and distributed. These sets consisted primarily of solutions of various agents, both foreign and domestic. Many of these sets were buried and only a portion of them (less than half) are currently accounted for (Moore 1996). Most of those that are not accounted for were likely used during training or combat. DSHW believes that although many of the agents contained in CAIS are not part of the U.S. stockpile, these should be considered hazardous waste and is therefore proposing that agents contained in these sets be identified as commercial chemical products. Chemical agents contained in these sets that are proposed as commercial chemical products are HD (or H), L, HN1, HN3, DM, CK and CG.

CK and CG are common industrial chemicals and are already listed by EPA as acutely toxic commercial chemical products (P033 and P095, respectively) and as hazardous constituents in 40 CFR 261, Appendix VIII. DSHW is not proposing to change these listings. However, DSHW proposes to include these listings in today's proposed rule for continuity. While this action would result in double listings (i.e., in EPA rules that the state has adopted and in state rules), DSHW believes that this action will ease understanding of and compliance with the rule.

The CAIS also included other chemicals: triphosgene (simulant for CG), GA simulant, PS, and CN. DSHW is not proposing these as commercial chemical products. DSHW's rationale for this decision is as follows:

- *Triphosgene and GA simulant* are not chemical agents but rather are used as simulants for chemical agents. They were used as simulants because they are substantially less toxic than their respective agent counterparts.

- *PS and CN*, as explained earlier, are tear gases, and DSHW does not wish to propose regulating these chemicals.

A more difficult determination with respect to commercial chemical products deals with chemical agent mixtures. As indicated above, the term commercial chemical product, by EPA's definition [40 CFR 261.33(d)(Comment)], refers to a chemical substance in which the chemical is the "sole active ingredient." Three "agents" really consist of mixtures of two chemicals: HL is a mixture of sulfur mustard and lewisite, HT is a mixture of sulfur mustard and T-mustard, and HQ is a mixture of sulfur mustard and Q-mustard. In these cases, clearly, there are two active ingredients. Complicating the picture a little more, of these three mixtures, only HT is actually included in the U.S. chemical stockpile. DSHW proposes to regulate stockpile mixtures as commercial chemical products even though they consist of two active ingredients. Hence, HT, HQ, and HL are being proposed as commercial chemical products. This action is somewhat more conservative and inclusive than is EPA practice.¹⁷

Also existing are (1) chemical materials that were experimental agents at one time but that were never stockpiled, and (2) agents that may be maintained in foreign countries, but that were not produced or stockpiled in the United States. DSHW does not consider these chemicals as commercial chemical products.¹⁸ However, if a foreign chemical agent could be the subject of testing at places like Dugway Proving Ground, DSHW has proposed to include the chemical as a hazardous constituent (i.e., in Appendix VIII). Vx, the former Soviet Union's counterpart to VX, falls into this category.

Considering the above factors, proposed "P" chemicals include GB (P901), GA (P902), VX (P903), H/HD (P904), L (P905), HN1 (P906), HN3 (P907), HL (P908), HQ (P909), and HT (P910). CK and CG are also included under the chemical agent listings, but are already regulated by EPA under the RCRA regulations (P033 and P095, respectively).

DSHW also proposes to remove selected chemicals from the P999 category and to add others. Chemicals proposed to be removed include GD, T, HN2, and CX. While GD and T will be proposed as hazardous constituents, HN2 and CX are proposed to be removed from regulation entirely. HQ, is proposed to be added to the "P" designation.

¹⁷ Although HQ and HL are not in the U.S. chemical stockpile and are not in CAIS, DSHW is proposing these as commercial chemical products because they contain HD. DSHW does not expect that these "mixtures" will be found in Utah.

¹⁸ Some of these chemicals are also common industrial chemicals in the private sector. HN2, for example, which is not in the U.S. chemical stockpile, is a cancer treatment drug.

Chemicals proposed as "P" commercial chemical products are summarized in Section VII.B. Background Document B provides details regarding the chemical designations. Background Document C provides information on chemicals evaluated for this proposed rule but not proposed for regulation in any capacity, including HN2 and CX.

(3) *Should the chemical be listed in 40 CFR 261.33(f) [adopted in R315-2-11(e)] as a toxic (but not acutely toxic) "U" commercial chemical product?*

While EPA has established quantitative criteria for determining if a chemical is acutely toxic, no regulatory-based quantitative criteria exist for determining if a chemical is "toxic." EPA's definition, as indicated above, is that a chemical is toxic if it has been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms [40 CFR 261.11(a)(3)]. DSHW examined EPA's original listing of "P" and "U" chemicals per the original RCRA May 19, 1980, final rule and determined that no quantitative criteria were applied to differentiate "U" compounds from "nontoxic" materials. DSHW does not wish to establish quantitative criteria for "U" listing as part of this rulemaking. However, according to the Army, several of the "agents" were developed not for their lethal effects, but for their incapacitating effects. For example, adamsite (DM) and several other of the "agents" fall into the category known as sternutators (vomiting compounds). BZ was developed as a central nervous system depressant and is a hallucinogen.

DSHW is today proposing to designate specific chemical agents that were developed for their incapacitating effects, rather than lethal effects, as "U" commercial chemical products. These agents include DM and BZ. DM is proposed as U901 and BZ is proposed as U902.

The same criteria for defining commercial chemical products discussed above for "P" chemicals are applied here for "U" chemicals.

(4) *Should the chemical be listed in 40 CFR 261 Appendix VIII (adopted in R315-50-10) as a toxic (or acutely toxic) hazardous constituent?*

As indicated above, substances are listed as Appendix VIII hazardous constituents if they have been shown in scientific studies to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans or other life forms [40 CFR 261.11(a)(3)]. Hence, the criteria for listing chemical agents and associated chemicals in DSHW's R-315-50-10 are established as follows:

- Any individual chemical in the "P" or "U" categories should be listed in Appendix VIII.
- Additional chemicals that should be listed in Appendix VIII include chemicals that meet the "P" or "U" toxicity criteria defined above and that:
 - Are significant agent by-products/impurities, intermediates, and breakdown products from "P" or "U" chemicals that could be present in agent associated wastes, or
 - Are significant agent breakdown products from "P" or "U" chemicals that may form as a result of environmental degradation.

Chemicals that meet the criteria for Appendix VIII listing are GB, GD, GA, GF, VX, HD, L1, HN1, HN3, DM, Q, T, L2, L3, EA2192, LO, Vx, CK, CG, BZ, HF, chloroform, and arsenic. The listing of these chemicals as a basis for listing "K" wastes is summarized in Section VII.B. The rationale for listing these chemicals as hazardous constituents in Appendix VIII is provided in Background Document B. Note that CK, CG, HF, chloroform, and arsenic are included as Appendix VIII constituents under the federal program. Their dual listing in today's proposed rule is done for consistency and does not affect the federal listing.

(5) Should the chemical be listed in 40 CFR 261 Appendix VII (adopted in R315-50-9) as a basis for listing?

Any chemical listed in Appendix VIII that is typically present in a "K" process waste stream is proposed for listing in Appendix VII (40 CFR 261.30(b)). DSHW has not conducted a listing study, such as those typically conducted by EPA to support listing, for several reasons. First, the Army has provided information to DSHW to determine which waste streams are "K" wastes, and what constituents are or may be contained in these wastes. Second, DSHW has learned a great deal regarding agent wastes through administering its existing regulations and through information provided by the Army. Finally, listing studies typically cost EPA up to several million dollars each. More information on the proposed "K" process waste streams is provided in Section VIII of this Preamble.

All of those chemicals proposed to be included in the addition to Appendix VIII are also proposed to be included in Appendix VII. These chemicals are GB, GD, GA, GF, VX, HD, L1, HN1, HN3, DM, Q, T, L2, L3, EA2192, LO, Vx, CK, CG, BZ, HF, chloroform, and arsenic. The listing of these chemicals as a basis

for listing "K" wastes is summarized in Section VII.B. Details are provided in Background Document B. HN2 and CX are proposed to be removed from regulation entirely, as described in Background Document C.

(6) *Should the chemical be listed in 40 CFR 264 Appendix IX (adopted in R315-50-14) as a groundwater monitoring constituent?*

As indicated above, the Army has provided data and information to DSHW indicating that the key chemical agents that are examined in today's proposed rule are quickly degraded (typically through hydrolysis) into other compounds in a hydrolytic environment. DSHW agrees with this position. DSHW is, however, proposing to add significant agent breakdown products, particularly those that are relatively stable in groundwater, to the list of groundwater monitoring constituents (40 CFR 264 Subpart F). The following criteria for Appendix IX listing are established:

- The chemical has a breakdown (e.g., long hydrolysis half life) such that it is unlikely to be degraded before the "plume" would travel any significant distance.
- That breakdown product per parent agent that is most likely to be detected, on the basis of chemical properties and other considerations, is proposed for addition to Appendix IX.

Breakdown products that are most likely to be detected, on the basis of chemical properties, are therefore proposed for addition to Appendix IX, as adopted in R315-50-14. Chemicals proposed to be added as groundwater monitoring constituents are:

- EMPA, an indicator for VX;
- TDG, an indicator for HD, HT, HQ and HL;
- MPA, an indicator for GB, GD, GF, VX, EA2192, IMPA, and EMPA;
- IMPA, an indicator for GB; and
- Arsenic, an indicator for L1, L2, L3, DM, LO, and HL.

The listing of these chemicals as groundwater monitoring constituents is summarized in Section VII.B. The rationale for including these chemicals in

Appendix IX is provided in Background Document B. Because arsenic is ubiquitous in the environment, monitoring must be designed to determine if concentrations are significantly above background.

B. PROPOSED DISPOSITION OF CHEMICALS

Background Document B, *Chemicals Proposed for Regulation*, offers a review of relevant information on each chemical that is included in today's proposed rule and concludes with disposition with respect to today's proposed rule. Note that HF, chloroform, and arsenic, although proposed as hazardous constituents for the chemical agent listings, are not included in Background Document B. HF is a breakdown product of the G agents, and chloroform is included because it is used as a solvent for several of the CAIS. Arsenic is a component of arsenicals, such as L and DM, and is also a component of related compounds, such as L2, L3 and LO. HF, chloroform, and arsenic are not included individually in the discussions in Background Document B because they are already listed as hazardous constituents by EPA regulations (40 CFR 261, Appendix VIII) that DSHW has adopted in R315-50-10.

Table VII-1 summarizes today's proposed chemical listings. The table includes those chemicals evaluated for today's proposed rule that were identified in DSHW's 1996 draft version of the proposed rule but were not selected for regulation in any capacity. The key to this table follows:

- **Columns 1-3: Chemical Identification Information**

Column 1: Chemical name.

Column 2: Synonym for chemical, if applicable.

Column 3: Chemical Abstracts Service (CAS) Registry Number, if applicable.

- **Columns 4-8: Disposition of Chemical with Respect to Current DSHW Rule and Current EPA Rules**

Column 4: P999 indicates that the chemical is regulated as an acutely toxic commercial chemical product in the current Utah rule. PO__ indicates that the chemical is already regulated as an acutely toxic commercial chemical product in the current EPA rule, which DSHW has adopted.

Table VII-1 Master List - Disposition of Chemicals

CHEMICAL IDENTIFICATION			CURRENT UTAH/EPA RULES					D. UTAH RULE	PROPOSED RULE				
Chemical Name	Syn.	CAS No.	P List	F List	App. 7	App. 8	App. 9		P List	U List	App. VII	App. VIII	App. IX
O-Isopropyl methylphosphonofluoridate	GB, Sarin	107-44-8	P999	F999	Y	N	N	Y	P901	N	Y	Y	N
O-Pinacolyl methylphosphonofluoridate	GD, Soman	96-64-0	P999	F999	Y	N	N	Y	N	N	Y	Y	N
O-Ethyl, N,N-dimethyl phosphoramidocyanidate	GA, Tabun	77-81-6	P999	F999	Y	N	N	Y	P902	N	Y	Y	N
O-Cyclohexyl methylphosphonofluoridate	GF	329-99-7	N	N	N	N	N	Y	N	N	Y	Y	N
O-Ethyl S-(2-diisopropylaminoethyl) methylphosphonothioate	VX	50782-69-9	P999	F999	Y	N	N	Y	P903	N	Y	Y	N
Bis(2-chloroethyl) sulfide	H, HD, Mustard	505-60-2	P999	F999	Y	EPA	N	Y	P904	N	Y	Y	N
2-Chlorovinylchloroarsine	L, L1, Lewisite 1	541-25-3	P999	F999	Y	EPA	N	Y	P905	N	Y	Y	N
Bis(2-chloroethyl)ethylamine	HN1	538-07-8	P999	F999	Y	N	N	Y	P906	N	Y	Y	N
Tris(2-chloroethyl)amine	HN3	555-77-1	P999	F999	Y	N	N	Y	P907	N	Y	Y	N
Mixture of HD and Lewisite 1	HL	NA	P999	F999	Y	N	N	Y	P908	N	N	N	N
Mixture of HD and Q-Mustard	HQ	NA	N	N	N	N	N	Y	P909	N	N	N	N
Mixture of HD and T-Mustard	HT	NA	P999	F999	Y	N	N	Y	P910	N	N	N	N
Phenylarsazine chloride	DM, Adamsite	578-94-9	N	N	N	EPA	N	N	N	U901	Y	Y	N
1,2-Bis(2-chloroethylthio)ethane	Q, Q-Mustard	3563-36-8	N	N	N	N	N	Y	N	N	Y	Y	N
Bis(2-chloroethylthioethyl) ether	T, T-Mustard	63918-89-8	P999	F999	Y	N	N	Y	N	N	Y	Y	N
Bis(2-chlorovinyl)chloroarsine	L2, Lewisite 2	40334-69-8	N	N	N	EPA	N	Y	N	N	Y	Y	N
Tris(2-chlorovinyl)arsine	L3, Lewisite 3	40334-70-1	N	N	N	EPA	N	Y	N	N	Y	Y	N
S-(2-diisopropylaminoethyl) methylphosphonothioic acid	EA-2192	73207-98-4	N	N	N	N	N	N	N	N	Y	Y	N
Ethyl methylphosphonic acid	EMPA	1832-53-7	N	N	N	N	N	N	N	N	N	N	Y
Thiodiglycol	TDG	111-48-8	N	N	N	N	N	N	N	N	N	N	Y
Methylphosphonic acid	MPA	993-13-5	N	N	N	N	N	N	N	N	N	N	Y
Isopropyl methylphosphonic acid	IMPA	6838-93-3	N	N	N	N	N	N	N	N	N	N	Y
2-Chlorovinylarsenous oxide	LO, Lewisite oxide	3088-37-7	N	N	N	EPA	N	N	N	N	Y	Y	N
S-2(2-diethylamino)ethyl O-isobutyl methylphosphonothioate	Vx	159939-87-4	N	N	N	N	N	N	N	N	Y	Y	N
Cyanogen chloride*	CK	506-77-4	P033	N	N	EPA	N	N	P033	N	Y	Y	N
Phosgene*	CG	75-44-5	P095	N	N	EPA	N	N	P095	N	Y	Y	N
3-Quinuclidinyl benzilate	BZ	13004-56-3	N	N	N	N	N	Y	N	U902	Y	Y	N
Hydrogen fluoride/Hydrofluoric acid*	HF	7664-39-3	U134	N	N	EPA	N	N	N	U134	Y	Y	N
Trichloromethane*	Chloroform	67-66-3	U044	N	N	EPA	EPA	N	N	U044	Y	Y	N
Arsenic*	Arsenic	7440-38-2	N	N	N	EPA	EPA	N	N	N	Y	Y	Y
Bis(2-chloroethyl)methylamine	HN2	51-75-2	P999	F999	Y	EPA	N	Y	N	N	N	N	N
Phenyldichloroarsine	PD	696-28-6	N	N	N	EPA	N	Y	N	N	N	N	N
Ethyldichloroarsine	ED	598-14-1	N	N	N	EPA	N	Y	N	N	N	N	N
Methyldichloroarsine	MD	593-89-5	N	N	N	EPA	N	Y	N	N	N	N	N
Methylphosphonyl difluoride	DF	676-99-3	N	N	N	N	N	Y	N	N	N	N	N
O-Ethyl O-(2-diisopropylaminoethyl) methylphosphonite	QL	57856-11-8	N	N	N	N	N	Y	N	N	N	N	N
O-Isopropyl methylphosphonochloridate	Chlorosarin	1445-76-7	N	N	N	N	N	Y	N	N	N	N	N
O-Pinacolyl methylphosphonochloridate	Chlorosoman	7040-57-5	N	N	N	N	N	Y	N	N	N	N	N
Phosgene oxime	CX	1794-86-1	P999	F999	Y	N	N	Y	N	N	N	N	N
Diphosgene	DP	503-38-8	N	N	N	N	N	Y	N	N	N	N	N

* These chemicals are already regulated under 40 CFR Part 261; the proposed Utah Chemical Agent Rule will not affect these listings.

Column 5: F999 indicates that process waste streams (residues from demilitarization, treatment, and testing) associated with these chemicals are regulated in the current DSHW rule. EPA currently has no similar listing in its RCRA regulations.

Column 6: A "Y" (Yes) indicates that DSHW has included this chemical in its current rules as an addition to 40 CFR 261, Appendix VII "Basis for Listing." EPA currently has no similar listing in its RCRA regulations.

Column 7: DSHW's current regulations do not include any additions to 40 CFR 261, Appendix VIII. HD and HN2, and all the compounds listed by EPA under the "P" list, are specifically listed by EPA in 40 CFR 261, Appendix VIII; the remaining compounds identified as "EPA" are included in Appendix VIII through EPA's inclusion of "Arsenic compounds N.O.S. (Not Otherwise Specified)."

Column 8: DSHW's current regulations do not include any additions to 40 CFR 264, Appendix IX - Groundwater Monitoring List. None of these compounds is included in EPA's Appendix IX. Note that chloroform and arsenic are in EPA's Appendix IX.

- **Column 9: Disposition of Chemical with Respect to DSHW's February 1996 Draft Proposed Rule**

Column 9: A "Y" (Yes) indicates that the chemical was included in DSHW's draft proposed rule that was released to the Army for comment in February 1996.

- **Columns 10-14: Disposition of Chemical with Respect to Today's DSHW Proposed Rule**

General: Chemicals above the dark line (located above the chemical HN2 [Bis(2-chloroethyl)methylamine]) are proposed for regulation in today's proposed rule in some capacity and are discussed in Preamble

Sections VII.A and B, as well as in Background Document B. Chemicals below the dark line (located below the chemical Arsenic) are not proposed for regulation in today's proposed rule in any capacity because they do not meet the criteria for listing established in today's rule. These chemicals are discussed in Background Document C.

Column 10: A "P" code indicates that the chemical is proposed for inclusion in today's proposed rule as an acutely toxic commercial chemical product ("P" list chemical).

Column 11: A "U" code indicates that the chemical is proposed for inclusion in today's proposed rule as a toxic commercial chemical product ("U" list chemical).

Column 12: A "Y" (Yes) indicates that the chemical is proposed for inclusion in today's proposed rule as an Appendix VII basis for listing of one or more "K" process waste streams.

Column 13: A "Y" (Yes) indicates that the chemical is proposed for inclusion in today's proposed rule as an Appendix VIII hazardous constituent.

Column 14: A "Y" (Yes) indicates that the chemical is proposed for inclusion in today's proposed rule as an Appendix IX groundwater monitoring constituent.

VIII. HAZARDOUS WASTE RELISTINGS — PROCESS WASTES

The term "process wastes," in the context of today's proposed rule, refers primarily to those waste streams that are generated from the treatment, storage, or disposal of the chemical agents proposed to be listed under the new commercial chemical product ("P" and "U" waste) listings. Today's proposed rule would remove the 1988 generic F999 listing that applied to all chemical agent process wastes and replace it with more specific "K" waste listings. The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) developed the proposed "K" listings with the goal of being unambiguous and mutually exclusive.

A summary of the "K" waste listing approach DSHW has taken for today's proposed rule is provided in Section VIII.A. Section VIII.B provides an overview of each of the proposed listing categories, identifying the rationale for the listing and indicating specific waste streams that are included in each category. It concludes with a comprehensive table that identifies relevant information regarding each waste stream generated by the various agent activities and installations in Utah. Section VIII.C discusses the effect of the rule on specific waste residues.

A. LISTING APPROACH

As indicated in the 40 CFR 261.33(d) Comment, the commercial chemical product listings in 40 CFR 261.33(e) and (f) do "not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f)." The U.S. Environmental Protection Agency (EPA) further indicates under the 40 CFR 261.33(d) Comment that where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraph (e) or (f), such waste will be listed in either Section 40 CFR 261.31 or 40 CFR 261.32. EPA has, therefore, listed a number of waste streams under these sections, with "Wastes from Nonspecific Sources" in 40 CFR 261.31 and "Wastes from Specific Sources" in 40 CFR 261.32. These waste streams become hazardous waste when they meet the listing description. Wastes in the nonspecific sources category (40 CFR 261.31) are identified with "F" hazardous waste codes (e.g., F001, F002); wastes in the specific sources category (40 CFR 261.32) are identified with "K" hazardous waste codes (e.g., K001, K002). Wastes from nonspecific sources in 40 CFR 261.31 are generated by more than one industry, while wastes from specific sources in 40 CFR 261.32 are generated by one industry, usually by specific processes.

DSHW adopted EPA's 40 CFR 261.31 and 261.32 hazardous process waste listing regulations under R315-2-10(e) and (f), respectively. The only difference between EPA's listing regulations and DSHW's was the 1988 addition of chemical agent waste listings to R315-2-10. DSHW's 1988 final rule established a generic F999 waste code for "residues from demilitarization, treatment and testing of nerve, military and chemical agents." DSHW now proposes to remove the current F999 listing and the generic "999" designation, and identify specific process waste streams with individual "K" codes under R315-2-10(f). The following K-coded waste streams are proposed to be established:

- **K901** - Spent chemical neutralization solutions (including solids or particulates contained therein) used to neutralize chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K902** - Miscellaneous, physically solid, nonpermeable materials, such as glass or metal, that were contaminated with chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K903** - Miscellaneous physically solid, permeable materials, such as spent laboratory, monitoring and testing materials (including syringes, tubing, rags and wipes, gloves, aprons, and protective suits), wood, plastics, and organic materials, that were contaminated with chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K904** - Miscellaneous aqueous or nonaqueous liquid materials, such as antifreeze, refrigerants, and hydraulic fluids, that were contaminated with chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K905** - Spent carbon from both air filtration equipment and personal protective equipment that were contaminated with chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K906** - Ash, cyclone residue, and baghouse dust from incineration of chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K907** - Slag and refractory generated from incineration of chemical(s) listed in R315-2-11(e)(1) or (f)(1).
- **K908** - Brine salts, liquids, solids and sludges generated from pollution abatement systems, including those used in conjunction with incineration or chemical neutralization,

employed in operations with chemical(s) listed in R315-2-11(e)(1) or (f)(1).

These waste streams are all proposed to be listed because they typically or frequently contain (or at one time contained) toxic constituents — specifically, one or more of the chemical agents or associated compounds proposed to be added to the list of hazardous constituents in R315-50-10 (adopted from EPA's 40 CFR 261, Appendix VIII). The chemicals include the chemical agent commercial chemical products ("P" and "U" chemicals) proposed to be added to R315-2-11 (e) and (f), as well as additional chemicals determined to be toxic, that are associated with the chemical agents, such as agent breakdown products (products of agent degradation or decomposition). These chemicals were identified in Section VII of the preamble.

1. Criteria for Listing

EPA has established [under 40 CFR 216.11(a)(3)] that a waste can be listed as a hazardous waste if it contains any of the toxic constituents listed in 40 CFR 261, Appendix VIII (adopted in R315-50), after considering 11 factors. These factors, adopted by DSHW in R315-2-9(c), are reiterated below:

- a. The nature of the toxicity of the constituent.
- b. The concentration of the constituent in the waste.
- c. The potential of the constituent or any toxic degradation product of the constituent to migrate from the waste into the environment (if improperly managed).
- d. The persistence of the constituent or any toxic degradation product.
- e. The potential of the constituent or any toxic degradation product to degrade into non-harmful constituents and the rate of degradation.
- f. The degree to which the constituent or any degradation product bioaccumulates in ecosystems.
- g. The plausible types of improper management to which the waste could be subjected.
- h. The quantities of the waste generated at individual generation sites or on a regional or national basis.
- i. The nature and severity of human health and environmental damage that has occurred as a result of the improper management of wastes containing the constituent.
- j. Action taken by other governmental agencies or regulatory programs based on health or environmental hazard posed by the waste or waste constituent.
- k. Such other factors as may be appropriate.

These 11 factors are assessed, in general, against the types of process wastes proposed to be added by today's rule in Section A.5 below.

DSHW would like to clarify one point regarding its proposed relisting of the "K" wastes. All of the proposed agent process waste listings have been regulated under DSHW's F999 listing category since the initial agent rule was promulgated in July 1988. Today's rule merely proposes reorganization of the affected waste streams into more specific categories, on the basis of physical/chemical properties, to simplify the identification of LDR treatment technologies. No new process waste streams are proposed to be included as hazardous wastes, and no process waste streams that were previously considered hazardous waste are proposed to be removed from regulation. DSHW therefore believes that it is not required to rejustify listing of these waste streams against the 11 factors identified above. It is doing so, however, to provide complete and updated information on the wastes proposed to be listed.

2. Removal of F999

DSHW's existing rule, in place since 1988, includes all process waste streams under the generic F999 designation. Standard EPA practice is to establish separate listings for different categories of process waste streams, even if such waste streams originate from the same industry. Hence, for example, there are a number of different "K" waste listings for wastes emanating from the petroleum refining industry (40 CFR 261.32, K048-K052). DSHW is therefore proposing today to remove the generic F999 designation in favor of more specific "K" listing categories.

Furthermore, DSHW is proposing to establish "K" listings on the basis of a waste's physical and chemical properties. In this manner, appropriate treatment technologies for these specific waste categories can be readily established, because the same technology is generally applicable to wastes containing the same types of hazardous constituents and having the same general physical/chemical properties. This minimizes the need to create individual "treatability groups" within the "K" listing categories, as has been EPA's practice for establishing treatment standards for some waste types.

Finally, DSHW notes that in general, all the proposed "K" wastes result, either directly or indirectly, from the destruction or demilitarization of "P" or "U" wastes — the original chemical agents. The United States has committed to destroying its military chemical agent stockpile by the year 2007 (*National Defense Authorization Act of 1986*). In addition, in April 1997, the United States ratified the Chemical Weapons Convention, binding the United States by international treaty to destroy its stockpile of chemical weapons within 10 years (*Convention on*

the Prohibition of the Development, Production, Stockpiling, and Use of the Chemical Weapons and on Their Destruction, January 13, 1993). The general intent of the Convention is to destroy chemical munitions. At some point in their life cycles, these munitions will become waste, and at that time, their disposition will be regulated under RCRA, as implemented by DSHW under the R315 regulations.

Because the chemical agent stockpile in Utah is to be destroyed and because testing and evaluation procedures ultimately result in chemical agent destruction, DSHW believes that all the waste streams that result from this destruction should be identified as process wastes. Hence, in all cases, the original waste chemical agent (the "P" or "U" listed waste) ceases being designated as the "P" or "U" listed waste following its destruction or treatment. At that point, these waste streams become identified as specific process "K" wastes. This transition from "P" or "U" commercial chemical product waste to "K" process waste is depicted in the flow diagram shown in Figure VIII-1.

DSHW notes that under its 1988 rule, residuals resulting from treatment of the "P" wastes (i.e., P999) were all designated as F999. DSHW's proposal to redesignate these residuals under more specific "K" waste categories is no more or less stringent than the regulations prescribed in the original 1988 rule.

3. Wastes from Specific vs. Nonspecific Sources

Process wastes can be placed either under Wastes from Nonspecific Sources - "F" listed wastes [R315-2-10(e)], or Wastes from Specific Sources - "K" listed wastes [R315-2-10(f)]. Given that the "K" listings are used by EPA for wastes from specific sources or industries, and considering that the military is perceived by DSHW as an industry, DSHW proposes to establish "K" codes for specific agent associated process waste streams under R315-2-10(f). This proposal represents a departure from DSHW's current listing, where the F999 code for the current agent waste listing appears under R315-2-10(e). There is no difference in the level or stringency of regulation for a "F" vs. a "K" listing.

The new process "K" waste listings proposed in today's rule are intended to facilitate the identification of LDR treatment standards by grouping waste streams together in terms of general physical and chemical characteristics. Eight different process waste categories are established. Section VIII.B provides information on the types of waste streams included in each listing category.

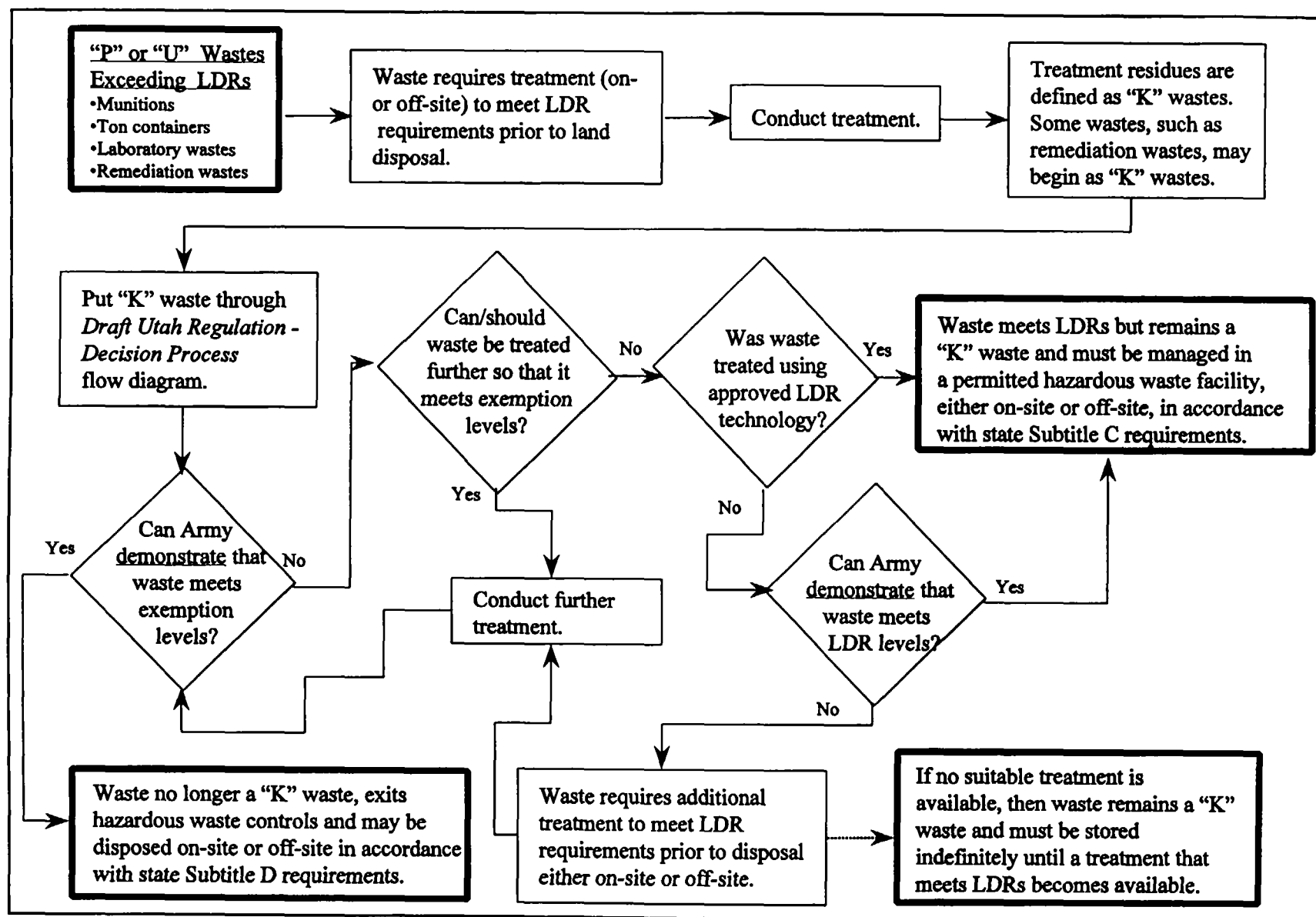


FIGURE VIII-1 Proposed UCAR — Cradle to Grave Chemical Agent Waste Disposition

4. 40 CFR 261, Appendix VII — Basis for Listing

To support listing of "F" and "K" wastes, EPA conducts a listing study, which includes examination of waste streams for the presence of Appendix VIII hazardous constituents. If EPA finds that certain waste streams typically contain significant amounts of Appendix VIII hazardous constituents, it will usually propose listing of these waste streams.¹⁹ EPA established Appendix VII of 40 CFR 261 to serve as a basis for listing. Accordingly, Appendix VII identifies specific hazardous constituents that were the "basis for listing" of "F" and "K" waste streams. Hence, chemicals listed in Appendix VII should already have been listed in Appendix VIII.²⁰

In the 1988 final chemical agent rule, DSHW included the chemical agents identified under R315-2-11 as the basis for listing the F999 hazardous wastes and added these to 40 CFR 261 Appendix VII (as adopted in R315-50-9). In today's rule, DSHW is proposing to remove the existing R315-50-9 listing and replace it with a new R315-50-9 listing of hazardous constituents for the proposed new "K" listings.

Each designated "K" waste is proposed to be listed because it may contain, or may have contained, one or more of the hazardous constituents proposed to be listed in R315-50-10. Included are the chemicals in Table VIII-1, identified by chemical name, common name, CAS number, and "P" or "U" code, as applicable.

Although Appendix VII will identify all the chemicals in Table VIII-1 as constituents of concern for each listed "K" waste, in all but the very rarest of cases, individual listed "K" wastes will contain, or will have contained, only one or a small subset of the Appendix VII basis-for-listing chemicals (as adopted in R315-50-9). For example, at the Tooele Operations Chemical Disposal Facility (TOCDF), incineration campaigns are only conducted for one type of chemical agent or munition item at a time. The first TOCDF campaign involved the destruction of M55 rockets loaded with the agent GB. Thus, it is apparent that GB might be contained in one or more of the various incineration residues listed as "K" waste, but that the presence of any of the other listed hazardous constituents (except certain breakdown products of GB) would be all but impossible. DSHW believes that conducting analyses, if required, for all the R315-50-9 (Appendix VII) listed chemicals would be a gross misuse of resources. In this case, therefore, and

¹⁹ EPA will also examine wastes to determine if they exhibit any of the four RCRA characteristics (40 CFR 216.21-24). EPA may decide not to specifically list waste streams if they typically exhibit one or more RCRA characteristics.

²⁰ EPA can, and has, established Appendix VIII listings at the same time that it has established "K" listings and listings in Appendix VII.

TABLE VIII-1 Hazardous Constituents

Common Name(s)	Chemical Abstracts Name	Chemical Abstracts No.	Hazardous Waste No.
GB, Sarin	O-Isopropyl methylphosphonofluoridate	107-44-8	P901
GD, Soman	O-Pinacolyl methylphosphonofluoridate	96-64-0	NA ^a
GA, Tabun	O-Ethyl N,N-dimethyl phosphoramidocyanidate	77-81-6	P902
GF	Cyclohexyl methylphosphonofluoridate	329-99-7	NA
VX	O-Ethyl S-(2-diisopropylaminoethyl) methylphosphonothioate	50782-69-9	P903
H, HD, Mustard Gas	Bis(2-chloroethyl) sulfide	505-60-2	P904
L, L1 Lewisite, Lewisite 1	2-Chlorovinylchloroarsine	541-25-3	P905
HN1	Bis(2-chloroethyl)ethylamine	538-07-8	P906
HN3	Tris(2-chloroethyl)amine	555-77-1	P907
DM, Adamsite	Phenylarsazine chloride	578-94-9	U901
Q Mustard	1,2-Bis(2-chloroethylthio)ethane	3563-36-8	NA
T Mustard	Bis(2-chloroethylthioethyl) ether	63918-89-8	NA
Lewisite 2	Bis(2-chlorovinyl)chloroarsine	40334-69-8	NA
Lewisite 3	Tris(2-chlorovinyl)arsine	40334-70-1	NA
EA2192	S-(2-diisopropylaminoethyl) methylphosphonothioic acid	73207-98-4	NA
LO, Lewisite oxide ^b	2-Chlorovinylarsenous oxide	3088-37-7	NA
Vx	S-2(2-diethylamino)ethyl O-isobutyl methylphosphonothioate	159939-87-4	NA
CK ^c	Cyanogen chloride	506-77-4	P033
CG ^c	Phosgene	75-44-5	P095
BZ	3-Quinuclidinyl benzilate	13004-56-3	U902
HF ^c	Hydrogen fluoride/Hydrofluoric acid	7664-39-3	U134
Chloroform ^c	Trichloromethane	67-66-3	U044
Arsenic ^c	Arsenic	7440-38-2	NA

^a NA = not applicable.

^b LO hydrolyzes to 2-chlorovinylarsonous acid (CVAA) in aqueous systems.

^c These chemicals are already regulated as hazardous constituents under RCRA; the proposed rule will not affect these listings.

in cases like it, DSHW has provided in today's proposed rule that the generator may use process knowledge to determine what specific hazardous constituents should be analyzed (where analyses are required). Thus, analyses would only need to be conducted for constituents that "can reasonably be expected to be present at the point of generation of the hazardous waste" [40 CFR 261.2(i)]. This concept is similar to RCRA's provisions [under the LDR, 40 CFR 268.7(a)] for determining if a restricted waste has underlying hazardous constituents. Underlying hazardous constituents are discussed in Preamble Section IX.

Note that CK and CG have been previously listed by EPA under RCRA as commercial chemical products under 40 CFR 261.33(e). Hence, these chemicals are also previously listed by EPA under RCRA as Appendix VIII hazardous constituents. Also, HD, chloroform, and arsenic are already identified as Appendix VIII hazardous constituents, as adopted in R315-50-10. For continuity, DSHW is proposing to add these chemicals as Appendix VII hazardous constituents for the agent associated "K" wastes. This action does not change the previous EPA listings.

5. Comparison with EPA's Criteria for Listing

The 11 R315-2-9 factors [as adopted from EPA's 40 CFR 261.11(a)(3)] are repeated below, followed by an explanation as to how they relate to the proposed "K" waste streams.

a. The Nature of the Toxicity of the Constituent

The "K" waste streams that are proposed to be added to DSHW's regulations, in place of the current F999 listing, are so proposed because they may contain, or may have contained, one of more of the hazardous constituents proposed to be added to the list of hazardous constituents that DSHW has adopted in R315-50-10. Section VII of this Preamble identified these hazardous constituents; Background Document B provides additional detail. These constituents include chemical agents and associated compounds, such as breakdown products. They are proposed to be added to R315-50-10 because they are acutely toxic or toxic [RCRA definition, as in 40 CFR 261.33(e) and (f)].

b. The Concentration of the Constituent in the Waste

DSHW is making a clear distinction in this proposed rule between wastes that consist of the pure or nearly pure chemical agents (such as are contained in munition items and bulk containers) and those waste streams that may contain, or may have contained, relatively small amounts of these compounds. The pure or nearly pure chemical agents are regulated under the proposed "P" and "U" waste

listings, whereas wastes such as destruction and treatment residues are addressed herein under the proposed "K" waste listings. Whereas the "P" wastes consist of high levels of the proposed hazardous constituents, ranging from 28 to 100%, the "K" wastes contain (or contained) one or more of these hazardous constituents at far lower levels, most often at fractions of a percent, such as parts per million (ppm) or parts per billion (ppb) levels.

In most cases, the "K" treatment residues are not expected to contain the hazardous constituent above detectable levels. These wastes are nevertheless proposed to be listed as "K" wastes. DSHW believes that they are prime candidates for exemption should the Army be able to demonstrate that the waste streams no longer contain the hazardous constituent(s) above the exemption levels proposed in today's rule (See Preamble Section XI).

c. The Potential of the Constituent or any Toxic Degradation Product of the Constituent to Migrate from the Waste into the Environment (if Improperly Managed)

Most of the hazardous constituents proposed to be added under today's proposed rule either are low-boiling liquids that become vapors when sprayed in the air or are liquids designed to be released as fine mists. These chemicals are entrained within the matrix of a "K" waste. The potential exists, however, for such constituents to migrate from a "K" waste if, for some reason, the waste is improperly managed. Given the Army's own regulations governing management of these wastes and the consequent tight controls over these wastes (as described in Section III to this Preamble), it is unlikely that these wastes would or could be mismanaged. In fact, the Army has a good record for management of the currently designated F999 wastes. If improperly managed, there is nevertheless the reasonable likelihood that hazardous constituents, if present in the wastes, could migrate from the waste.

d. The Persistence of the Constituent or Any Toxic Degradation Product

The toxic and environmental properties of the hazardous constituents proposed to be added to R315-50-10 are described in Background Document B. Most of the hazardous constituents proposed to be added in today's rule are relatively nonpersistent once released into the environment. The chemical agents are especially short-lived in moist or aqueous environments, where they are rapidly hydrolyzed or otherwise degraded, once dispersed. Hence, in all the groundwater monitoring that has been conducted at various old agent associated waste disposal sites located within some Army installations, like Dugway Proving Ground (DPG), chemical agents themselves are not known to have been detected. Appendix E of

Background Document E demonstrates that agent is not a threat to groundwater. While chemical agents could be detected in soil, under most conditions chemical agents will degrade rapidly over time.

The one possible exception to the above observations is for H/HD; bulk H/HD can persist in soil or surface water environments for extended periods of time, but once dissolved into the water phase (as it must be to migrate any significant distance in groundwater), it hydrolyzes rapidly (see Appendix E of Background Document E for details).

Note that DA Pamphlet 385-61, *Toxic Chemical Agent Safety Standards* (DA 1997b) refers to some agents, primarily the nerve agents GB and GD, as "nonpersistent agents," while referring to the blister agents such as mustard and lewisite, and some nerve agents (VX), as "persistent agents." DA Pamphlet 385-61, as well as Army Regulation 385-61 (DA 1997a) pertain primarily to worker safety (see Section III of Preamble for additional information). From a safety or tactical perspective, indeed, the blister agents and VX are far more persistent than the G agents. The mustard agents and VX, for example, may last for hours or days in the environment (and in rare cases, weeks), whereas the G agents generally persist for only minutes or hours. From an environmental perspective, however, and especially in a waste management scenario, the relative persistence of the chemical agents are comparable; they are relatively nonpersistent, as indicated above (see Background Document B for additional information).

Also of concern is the persistence of agent degradation products. These compounds include EA2192, EMPA, TDG, MPA, IMPA, and LO. Of these degradation products, only EA2192 (a degradation product of VX) and LO (a degradation product of lewisite) are considered sufficiently toxic to warrant their proposed listing in R315-50-10 as hazardous constituents.²¹ The other chemicals are proposed (as discussed in Section VII.B) for inclusion in R315-50-14 as groundwater monitoring parameters (not as hazardous constituents).

Considering the level of acute toxicity posed by most of the chemical agents and the fact that some of the agent degradation products pose a toxicity hazard as well, DSHW is proposing to list the proposed process wastes as "K" listed hazardous waste, even considering the relative lack of persistence of the parent agents.

²¹ LO can hydrolyze to CVAA. See Background Document B for details.

e. *The Potential of the Constituent or Any Toxic Degradation Product to Degrade into Nonharmful Constituents and the Rate of Degradation*

This degradation factor was discussed above in item d. Again, the rate of degradation of the chemical agents proposed to be added as hazardous constituents is relatively rapid. With two exceptions, the degradation products are not sufficiently toxic to warrant listing as Appendix VIII hazardous constituents. These two exceptions, as indicated above, are EA2192 (a degradation product of VX), and LO (a degradation product of lewisite), which are proposed to be added to R315-50-10 (40 CFR 261, Appendix VIII) as hazardous constituents. Most of the agent degradation products are not sufficiently toxic to warrant their listing as hazardous constituents.

f. *The Degree to Which the Constituent or Any Degradation Product Bioaccumulates in Ecosystems*

For the most part, the chemical agents proposed to be added to R315-50-10 as hazardous constituents degrade so rapidly (as indicated above and described in Background Document B) that they would have little time to bioaccumulate if they were released to the environment. Although L and DM do contain arsenic, bioaccumulation was not a major consideration in proposing the process wastes for listing.

g. *The Plausible Types of Improper Management to Which the Waste Could Be Subjected*

The chemical agents (the "P" and "U" listed chemicals), primarily for security reasons, are not permitted out of Army control. As described in Section III of this Preamble, the Army has a rigorous system in place to ensure proper management of the chemical agents and process wastes. Overall, the Army has developed a good record with respect to management of these wastes. DSHW is not concerned with potential mismanagement of the process wastes while in the Army's possession. Rather, DSHW's concern is with potential mismanagement of process wastes at treatment or disposal facilities and by transporters. Listing these wastes as hazardous maintains RCRA controls, thus mitigating these concerns.

h. The Quantities of the Waste Generated at Individual Generation Sites or on a Regional or National Basis

Because today's proposed rule is a state rule, regional or national considerations do not apply. DSHW's concern is with those chemical agents and associated wastes generated and managed within the State of Utah.

Because of the current emphasis on destruction of the chemical agent stockpile, DSHW expects that the amount of process waste that will be generated over the next 5 to 10 years will remain constant or increase slightly. After the stockpile maintained in Utah is destroyed, DPG, one of the Army's primary research and test facilities for chemical agents, is expected to continue its operations. However, the amount of waste generated by DPG, in comparison with that expected to be generated through destruction of the stockpile, is very small.

DSHW also expects that the ongoing remediation of old agent associated waste disposal sites in Utah, and primarily at DPG and the Deseret Chemical Depot, may result in generation of various types of agent associated wastes. The Army's Rapid Response System (RRS) and similar systems are designed to address several types of wastes that may be generated during remediation. DSHW's preference, however, would be that any necessary remediation would be conducted in situ, resulting in generation of little or no remediation waste. Eventually, however, waste generation by remediation activities will also decrease, leaving DPG as the only agent waste generator in Utah. Considering the toxic nature of the constituents present in these wastes, overall quantity of waste is not a primary consideration. More information on waste volumes is provided in Preamble Section VIII.B.

As an additional note, DSHW is proposing, as part of today's rule, to incorporate a small-quantity exclusion process for low-volume wastes (see Preamble Section VIII.C.6 for details).

i. The Nature and Severity of Human Health and Environmental Damage that Has Occurred as a Result of the Improper Management of Wastes Containing the Constituent

Various agent process wastes have been disposed of at a number of old agent associated waste disposal sites in the past. Remediation may be required at some of these locations. DSHW must point out, however, that for decades there have been no significant cases of human health or environmental damage due to the chemical agents defined as waste or the "K" process wastes that result from their destruction.

j. Action Taken by Other Governmental Agencies or Regulatory Programs Based on Health or Environmental Hazard Posed by the Waste or Waste Constituent

The most significant example of an action taken by a government agency or regulatory program is that taken by DSHW in 1988 to list the chemical agents and associated wastes as hazardous waste initially. Today's proposal to relist these chemical agents and associated wastes as hazardous may be perceived as a refinement of the 1988 action, preliminary to the development of LDRs and exemptions for the same waste streams.

In addition, however, DSHW notes that some states where stockpiles of chemical agents are maintained by the military regulate chemical agents as hazardous waste, including Oregon, Maryland, Indiana, Kentucky, Arkansas, Colorado, and Utah. Nevertheless, the Army's policy, in every case, has been to seek RCRA permits for all its stockpile demilitarization activities.

k. Such Other Factors as May Be Appropriate

DSHW believes that the above factors provide sufficient reason to warrant listing the agent associated process wastes as hazardous "K" wastes.

B. PROPOSED RELISTING — WASTE FROM SPECIFIC SOURCES

1. Description of Waste Generators

The industry affected by today's proposed regulation consists of the Army's storage, demilitarization, and research/test operations in Utah, including those at the Deseret Chemical Depot (DCD), Tooele Operations Chemical Destruction Facility (TOCDF), the Chemical Agent Munitions Disposal System (CAMDS), Dugway Proving Ground (DPG), and nonstockpile locations from which munitions or chemical agent identification sets (CAIS) may be recovered. The Army's Rapid Response System (RRS) and Munitions Management Device (MMD) are designed to treat these items at nonstockpile locations within the State of Utah. Operations at these locations are summarized below.

DCD is a chemical depot used for storage of chemical munitions. A portion of the Army's chemical agent stockpile is stored at DCD. Items in the stockpile become solid waste, subject to DSHW's hazardous waste regulations, when they are removed from the stockpile for purposes of destruction, or at an earlier point if these items are leaking. In addition, various types of other wastes generated in the

past may be stored at DCD. Such wastes include, for example, spent activated carbon, spent decontamination fluid, and recovered CAIS.

The chemical agent stockpile stored at DCD will be destroyed at TOCDF and CAMDS. Destruction of the stockpile items results in the generation of the various chemical agent associated wastes — the "K" wastes. Many different types of "K" wastes are generated from TOCDF operations, including incinerator ash (K906), slag and refractory (K907), and pollution abatement system wastes, such as dried brine salts (K908) and spent carbon (K905).

CAMDS is a research and test facility for the development of methods of demilitarization and treatment of chemical munitions. CAMDS operates under a DSHW research development, and demonstration (RD&D) permit, and the facility includes incinerators and similar thermal treatment devices for the destruction of the agents. The types of wastes generated at CAMDS are similar to those produced at TOCDF. Also, CAMDS is currently preparing to initiate chemical neutralization of lewisite contained in stockpiled munitions. Certain operations at CAMDS are proceeding through the full RCRA permit application process.

DPG conducts various types of testing involving chemical agent defensive materials, such as detectors, monitors, and protective clothing. Much of this testing is conducted with agent surrogate compounds (similar chemically to the agent, but far less toxic). However, small quantities of chemical agents are also used in the DPG test facilities and in laboratory settings. Prior to 1969, DPG was the site of open air testing of chemical agent delivery systems, such as rockets, bombs, and artillery. Today, all testing of chemical agents is conducted within contained facilities. The various chemical agent associated waste streams produced at DPG include spent chemical neutralization fluids (K901), test items (K902 and K903) that are subsequently neutralized,²² spent carbon (K905), and laboratory debris (K902 and K903). In addition, a number of old agent associated waste disposal sites located at DPG that may require remediation.

Chemical agent associated wastes also could be produced from future operations of the RRS and similar devices (e.g., the MMD) at nonstockpile locations within the State of Utah. The RRS is intended to be used for the treatment of chemical agent present in CAIS. The treatment concept of the RRS involves the use of chemical neutralization for detoxification of chemical agent followed by off-site treatment and/or disposal of the spent chemical neutralization fluids. Chemical agent associated waste streams include spent chemical neutralization solutions (K901) as well as treated dunnage (K902 and K903) and spent carbon (K905).

²² Within this preamble, neutralized and decontaminated and similar terms have the same meaning.

The MMD is intended for the treatment of nonstockpile chemical munitions, and will generate similar wastes.

Individual RCRA permits, RCRA permit applications, and other documentation describing these operations in detail are available for review at DSHW's public information center located at DSHW's offices in Salt Lake City, Utah. These documents are incorporated into the Administrative Record for today's rulemaking, located in the same public information center, by reference.

2. Description of Listed Wastes

This section describes each of the proposed "K" wastes. Section VIII.B.3 provides comprehensive listings of relevant waste stream data and information.

- a. *K901 - Spent Chemical Neutralization Solutions (including Solids or Particulates Contained Therein) Used to Neutralize Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

The Army uses several liquid chemical solutions capable of destroying (neutralizing) chemical agents on (or in) materials that have been exposed to the agents (often called substrates), including liquid solutions containing agents. These chemical neutralization solutions, often called decontamination, or decon, solutions, can be organic or inorganic. In some cases they may contain both organic and inorganic components. The chemical neutralization solutions include simple water (e.g., used to readily hydrolyze VX and HD, especially when heated); solutions of bleach [e.g., sodium hypochlorite, calcium hypochlorite, super tropical bleach (STB), high-test hypochlorite (HTH)], which is effective against most agents, and sodium hydroxide (e.g., 5 - 20% solutions), sometimes used in combination with simple solvents, such as alcohols.

More complex neutralization materials, such as those used as part of the RRS to destroy agents contained within CAIS [e.g., 1,3-dichloro-5,5-dimethylhydantoin (DCDMH) in a mixture of chloroform, t-butyl alcohol, and water] and those used as part of the MMD to destroy agent in nonstockpile chemical munitions, are also in use. Also included in this category is the Army's planned neutralization process for lewisite. DCD's entire stockpile of lewisite, 10 ton containers, will be destroyed at CAMDS through a neutralization process originally developed in 1991 by Chem-Security Ltd. to destroy the Canadian stockpile of lewisite. Lewisite is converted to sodium arsenate in a three-step batch process. CAMDS has already received a RCRA RD&D permit for this process, with operation scheduled to begin in early 1999.

Spent neutralization solutions from the RRS and MMD, and from neutralization of lewisite, are included under the K901 listing. However, as explained in Preamble Section IX, while other spent chemical neutralization solutions meet LDR standards as generated, spent chemical neutralization solutions from the RRS and MMD, and from neutralization of lewisite, do not meet LDR standards as generated, and LDR treatment is required.

Chemical neutralization liquids are used to neutralize or decontaminate specific items or liquid solutions of chemical agents, and when used eventually become spent. The definition of "spent" is provided in 40 CFR 261.1(c)(1) (adopted in R315-1-1) as "...any material that has been used and as a result of contamination can no longer serve the purpose for which it was produced without processing." DSHW does not propose a different definition. However, DSHW would offer some clarification. EPA developed this definition with solvents in mind. Solvents are used over and over again until they become so concentrated with solute and other chemicals that they are no longer an effective solvent. At this point, they become spent. Such is not necessarily the case with spent chemical neutralization fluid, however. The chemical neutralization fluid effectively breaks down the original agent such that the parent agent is not present (except in perhaps very minute amounts) in spent decontamination fluid (although the fluid may contain agent breakdown products). The chemical neutralization fluid becomes ineffective when the decontaminating entity, for example, hypochlorite ion (bleach), is no longer present in sufficient amounts to promote decontamination. At this point, the fluid is no longer an effective decontaminant and is considered spent.

Chemical neutralization is conducted using Standing Operating Procedures (SOPs) approved for use by the Army. Each installation will typically have its own SOPs developed to address site-specific considerations. Installations may, however, have similar SOPs for neutralizing the same agent or agent/substrate combination. Chemical neutralization is one of the LDR technologies approved for use in today's proposed rule (see Preamble Section IX). A comprehensive discussion of chemical neutralization solutions, their applications, and their effectiveness is provided in Background Document I.

- b. K902 - Miscellaneous, Physically Solid, Nonpermeable Materials, Such as Glass or Metal, That Were Contaminated with Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

and

- c. K903 - Miscellaneous Physically Solid, Permeable Materials, Such as Spent Laboratory, Monitoring, and Testing Materials*

(Including Syringes, Tubing, Rags and Wipes, Gloves, Aprons, and Protective Suits), Wood, Plastics, and Organic Materials, That Were Contaminated with Chemical(s) listed in R315-2-11(e)(1) or (f)(1)

The difference between the solids regulated under K902 and those under K903 deals with their permeability. DSHW proposes that nonpermeable materials (K902) would include materials such as glass, ceramics, and metals. Everything else would be defined as permeable (K903). These materials, both permeable and nonpermeable, are typically either subject to chemical neutralization or thermally treated. They may also be subject to incineration (e.g., empty munitions bodies or ton containers). Permeable and nonpermeable materials are often subject to the same type of treatment (e.g., same chemical neutralization fluid and the same installation SOP).

Nonpermeable materials can be readily and rapidly neutralized to the point where they no longer contain the chemical agent. These nonpermeable materials can qualify for the exclusion proposed within today's rule and, more often than not, can be recycled following chemical neutralization. Some permeable materials, on the other hand, may have a tendency to absorb the agent and can be more difficult to neutralize. Longer contact times between the chemical neutralization fluid and the contaminated material are needed, and, occasionally, vigorous agitation is needed. Although treatment by chemical neutralization is effective, permeable materials that have been neutralized may be more difficult to analyze (against the exemption levels), and, therefore, while they may qualify for the exemption, the Army is apt to not seek the exemption for these materials because of the cost and difficulty of analyses. Hence, DSHW believes that separate listing categories for these materials are warranted.

DSHW developed the proposed definitions of the K902 and K903 categories to be clearly mutually exclusive. However, some waste materials might consist of both permeable and nonpermeable components — for example, a plastic syringe with a metal needle. When possible and economically feasible, permeable and nonpermeable components would be segregated. Segregation would be a central part of a waste minimization program because many of the nonpermeable materials can be recycled. However, in other cases (i.e., where segregation is not feasible), the materials would be labeled as both K902 and K903. The determination of the specific LDR treatment technology(ies) that will be applied is discussed in Preamble Section IX. DSHW notes that any segregation of permeable from nonpermeable materials would not be considered as treatment and would not require a permit.

In some cases, neutralized materials, including both K902 and K903, may contain residual amounts of chemical neutralization fluid. For example, when

chemical neutralization is conducted in a drum, which is often the case, although spent chemical neutralization fluid may be drained from the drum, small amounts may remain in the container. In this case, the drum may be labeled as K901, and either K902 or K903, as appropriate. In rare cases, individual drums may carry K901, K902, and K903 designations.

- d. *K904 - Miscellaneous Aqueous or Nonaqueous Liquid Materials, Such as Antifreeze, Refrigerants, and Hydraulic Fluids, That Were Contaminated with Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

In the treatment, storage, or disposal of chemical agents and associated wastes, various aqueous and nonaqueous liquid materials may contact chemical agent associated materials. These liquids may include, for example, water, antifreeze, refrigerants, oils, and hydraulic fluids. Such materials would become subject to DSHW hazardous waste rules after they become a waste. For example, hydraulic fluid that may contain chemical agent is not subject to the DSHW rules until the fluid has become used or spent and is to be discarded.

- e. *K905 - Spent Carbon from Both Air Filtration Equipment and Personal Protective Equipment That Were Contaminated with Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

The Army uses activated charcoal or carbon in a number of its agent operations. Carbon filters are used in laboratory fume hoods; building heating, ventilation, and air conditioning (HVAC) units; pollution control devices and operations; agent storage or treatment units; and in personal protective masks. The spent carbon from such devices would be classified under K905. The Army also uses other types of filters in its agent operations in addition to carbon filters. Other filter types, including high-efficiency particulate air (HEPA) filters, HVAC prefilters, and cloth strainers, are not included in the K905 listing but instead are included in the K903 listing.

Carbon filters are used to remove chemical agent from air streams and, in rare cases, from other media. Furthermore, these filters may contain several kinds of carbon. For example, carbon differs as a function of source. The typical sources include coal-based and coconut-shell-based carbon. In addition, some carbon is impregnated with materials that facilitate absorption of the agent from the gas or liquid phase.

One of the materials that the Army has used in the past to facilitate absorption of the agent into the carbon includes chromium-based compounds. Because of chromium's hazardous properties, and because it is one of the RCRA

toxicity characteristic metals, the Army ceased manufacturing the chromium-containing carbon in the early 1990s. However, some of this material may still be in use at some installations. This type of carbon, once spent, could exhibit the RCRA toxicity characteristic for chromium (D007). Considering the small amount of carbon waste that is generated, the cost of conducting the TCLP on the carbon is greater than the cost differential if the waste were merely deemed as being in D007 and disposed of accordingly. Many installations follow this procedure. Considering that chromium-containing carbon may not exhibit the toxicity characteristic and that the Army has discontinued manufacturing it, DSHW has decided not to include the toxicity characteristic (D007) as a basis for listing the K905 waste stream.

Spent carbon typically contains or is associated with only one chemical agent. The Army conducts its demilitarization activities in phases or campaigns, which typically involve only one agent at a time. Filter change-out may occur between campaigns, as required. After filter change-out, the carbon becomes a solid waste. Carbon contained in laboratory fume hood filters is also usually only associated with one agent, because most fume hoods are dedicated to specific agents. The same is true of personal mask filters. However, on occasions, carbon may come in contact with more than one chemical agent.

Spent carbon may be perceived as being different from the other proposed "K" wastes, in a sense, because the carbon is known to contain, or potentially contain, chemical agent at some specific loading. Most of the other agent residues are treatment residues, where the treatment process was designed to destroy the agent. The Army has indicated to DSHW that carbon, at its heaviest loading, may contain up to percentage levels of agent. The agent will decompose naturally within the carbon pores, but this process occurs slowly unless water or water vapor is also present.

The presence of agent in spent carbon up to percentage levels has caused DSHW some concern. In a 8 May 1997 letter to the Army, DSHW expressed concern with the Army's plans for management of agent-exposed spent carbon (DSHW 1997). DSHW was not concerned about the Army's compliance with existing regulations; rather, DSHW was considering establishing additional requirements for management of this waste stream. One of the state's primary concerns dealt with "potential plans for commercial [off-site] management of contaminated carbon." The state was especially concerned about whether off-site commercial facilities are properly prepared (with appropriate equipment, procedures, training, and monitoring) to handle the waste, and about protection of human health and the environment in the event of transportation mishaps.

The Army responded to DSHW concerns by examining the sorption and desorption behavior of agent on carbon as a function of a number of factors, primarily temperature and water vapor content. Activated carbon is designed to attract and hold organic molecules very tightly within its pores, and the agent molecule will decompose within the carbon matrix. The chemical and physical processes of chemical agent adsorption does not differ from those other chemicals. Private industry has been using activated carbon for many years in industrial and laboratory settings to ensure worker safety and prevent pollution.

By controlling the carbon as a listed hazardous waste and requiring LDR treatment (discussed in Section IX), DSHW is minimizing potential hazard associated with the waste.

- f. K906 - Ash, Cyclone Residue, and Baghouse Dust from Incineration of Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

and

- g. K907 - Slag and Refractory Generated from Incineration of Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

The K906 and K907 listings pertain primarily to the incinerator residues produced by TOCDF and CAMDS. These residues are, for all practicable purposes, agent free, although they may contain agents or breakdown products at extremely low levels. These residues may also contain one or more of the RCRA heavy metals (cadmium, chromium, and lead) and may exhibit the RCRA toxicity characteristic. However, the toxicity characteristic is not proposed as a basis for listing. DSHW notes that the Army is not absolved from determining if listed agent wastes exhibit any of the RCRA characteristics. Generators of all listed wastes (and all solid wastes in general) are required to assess their wastes against the RCRA characteristics, and if the wastes exhibit these characteristics, additional requirements, as outlined in DSHW's regulations under R315, would apply.

The K906 and K907 wastes are considered by DSHW as prime candidates for the exemption. However, wastes exempted from meeting the listing description for the agent associated waste may nevertheless exhibit one or more of the RCRA characteristics, making them a RCRA characteristic waste. DSHW believes that there is a significant advantage in exempting the agent associated waste from the agent listings, even if the waste still exhibits one or more of the RCRA characteristics. For example, treatment of such wastes in accordance with LDRs would only need to address conventional RCRA requirements. Also, nonagent associated wastes could be disposed of commercially at a reduced cost to the Army.

- h. K908 - Brine Salts, Liquids, Solids and Sludges Generated from Pollution Abatement Systems, Including Those Used in Conjunction with Incineration, Thermal Drying, or Chemical Neutralization, Employed in Operations with Chemical(s) Listed in R315-2-11(e)(1) or (f)(1)*

The proposed K908 listing pertains to brine salts from incinerator pollution abatement systems, which may be contained within liquid matrices and sludges from sump systems, and which also may be dried to solid form. These residues are, for all practicable purposes, agent free, although they may contain agents or breakdown products at extremely low levels. They may also contain one or more of the RCRA heavy metals and may exhibit the RCRA toxicity characteristic. However, as with the K906 and K907 incinerator residues, the toxicity characteristic is not proposed as a basis for listing. Here again, DSHW notes that the Army is not absolved from determining if listed agent wastes exhibit any of the RCRA characteristics.

3. Summary Table of Waste Streams

Table VIII-2 identifies each waste stream generated by the various agent activities and installations in Utah. Table VIII-3, Part 1 through Part 33, provides relevant information regarding each waste stream. Information on waste volumes provided in Table VIII-3 represents estimates derived from informal discussions with waste generators.

4. Wastewaters vs. Nonwastewaters

Under the EPA LDR program (adopted by DSHW under R315-13), the LDR concentration-based standard applied depends on whether a waste is defined as a wastewater or nonwastewater. Wastewaters are defined in 40 CFR 268.2 as wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS), with exceptions pertaining primarily to liquid materials that contain organic solvents. Nonwastewaters are defined simply as materials that are not wastewaters. These definitions are important considering that the applicable LDR concentration-based standard depends on how the waste is classified.

DSHW notes that although some "liquid" waste may in some cases exceed the EPA TOC and TSS criteria for wastewaters, and thus may be defined as nonwastewaters, they are nevertheless liquid in nature. As explained in Preamble Section XI, the LDR standards for liquids and solids are derived using different exposure assumptions. In consideration, DSHW is proposing as part of today's rule

TABLE VIII-2 Identification of Agent Waste Streams

Number	Waste
1	Brine Reduction Area (BRA) Baghouse Residue
2	Brine Salts
3	Brine Tank Sludge
4	Chemical Neutralization Fluid
5	Deactivation Furnace System (DFS) Cyclone Residue
6	DFS Ash
7	DFS Refractory
8	Demilitarization Protective Ensemble (DPE) Suits
9	Laboratory Liquid Waste
10	Laboratory Solid Waste
11	Liquid Incinerator (LIC) Refractory
12	LIC Slag
13	Miscellaneous Metal Parts
14	Mist Eliminator Filters/Demister Candles
15	Metal Parts Furnace (MPF) Ash
16	MPF Metal
17	MPF Refractory
18	MPF Residue
19	Pollution Abatement System (PAS) Brine
20	PAS Pump Sludge
21	PAS Quench Tower Residue
22	Plastics
23	Residue Handling Area (RHA) Baghouse Residue
24	Soil
25	Spent Activated Carbon
26	Spent Hydraulic Fluid (including glycol/water mix from MMD-1)
27	Spent Silver Fluoride Pads
28	Spill Cleanup Material
29	Styrofoam
30	Trash, Debris and Protective Clothing
31	Waste Oil
32	Water/Groundwater
33	Wooden Pallets

TABLE VIII-3 General Information on Agent Process Waste Streams^a (see last page for table notes)

Part 1: Brine Reduction Area Baghouse Residue

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS TOCDF	0.02 0	0.01 < 100	0.01 < 100	Powdery solid	Inorganic	Permeable solid	F999	K908	D004-D011 (S)	CAMDS: Sporadic	CAMDS: Batches
Total	0.02	< 100.01	< 100.01							TOCDF: Routine	TOCDF: Routine

Current Storage	Typical Current Storage Time and Location	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums 4X4 boxes and rolloffs	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site	CAMDS: Off-site stabilization for metals will be conducted if required TOCDF: None	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	Same	Same	Same	None	CAMDS: Same TOCDF: If not characteristic, delisting may be attempted		Yes

TABLE VIII-3 (Cont.)

Part 2: Brine Salts

Generators	1993-1996 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS TOCDF	13.9 0	5.1 > 1000	2.9 > 1000	Granular solid	Inorganic	Permeable solid	F999	K908	D004-D011 (S)	Routine	Routine
Total	13.9	> 1005.1	> 1002.9								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums 3X3 foot bins and rolloffs	CAMDS: Permitted long-term storage on-site TOCDF: <90 day storage on-site	CAMDS: Off-site stabilization for metals will be conducted if required TOCDF: None	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	Same	CAMDS: May allow for accumulation at temporary (satellite) locations on-site	Same	Same	CAMDS: Same TOCDF: If not characteristic, delisting may be attempted.		Yes

TABLE VIII-3 (Cont.)

Part 3: Brine Tank Sludge

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
TOCDF	0	0	< 100	Sludge	Inorganic, possibly TCLP metals	Permeable solid	F999	K908	D004- D011 (S)	Infrequent	Batches

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rolloff boxes if no liquids present	< 90-day storage on-site	None	None	In state or out of state TSDf landfill	Same	Same	None	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 4: Chemical Neutralization Fluid

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	280.3	262.9	NA	Liquid containing precipitates	Inorganic, organic, pH, Corrosive, Special handling requirements, Ignitable	Aqueous liquid	F999	K901	D002, D004- D011, D022, D028, D034, D039, D040, D043 (S)	RRS, MMD: Sporadic	RRS, MMD: Batches
DCD	0	10	10								
DUGWAY	NA	NA	24								
TOCDF	0	0	0								
RRS	0	100-1000	100-1000								
MMD	0	100-1000	100-1000							CAMDS: DCD, DUGWAY TOCDF: Routine	CAMDS, DCD, DUGWAY TOCDF: Routine
Total	280.3	372.9 - 1272.9	130 - 1034								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
5- to 55-gallon drums and tanks	CAMDS, DCD, TOCDF: Permitted long- term storage on-site DUGWAY, RRS, MMD: < 90 day storage on-site (access to permitted storage)	CAMDS, TOCDF: Incineration on-site DCD: None DUGWAY, RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal	None	CAMDS: Out of state TSDF landfill DCD: In state TSDF landfill TOCDF: None DUGWAY, RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal	DUGWAY: May mix solids and liquids	Same	Same	None	Same	Information may require updating periodically	Yes

TABLE VIII-3 (Cont.)

Part 5: Deactivation Furnace System (DFS) Cyclone Residue

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS TOCDF	0.29 0	0 <100	NA <100	Powdery solid	Inorganic	Permeable solid	F999	K906	D004 - D011 (S)	CAMDS: Sporadic	CAMDS: Continuous during DFS operations
Total	0.29	<100	<100							TOCDF: Routine	TOCDF: Routine

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site	If metals present, off-site stabilization required	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 6: DFS Heated Discharge Conveyor Ash

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0	0.21	NA	Powdery solid	Inorganic	Permeable solid	F999	K906	D006, D008 (S)	CAMDS: Sporadic	Batches (both)
TOCDF	0	< 100	< 100								
Total	0	< 100.21	< 100							TOCDF: Routine	

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
CAMDS: 55-gallon drums	CAMDS: Permitted long term storage on site	Off-site stabilization for metals as needed	None	CAMDS: Out of state TSDF landfill	Same	Same	Same	None	Same		Yes
TOCDF: 4X4 boxes then emptied into rolloffs	TOCDF: < 90 day storage on site			TOCDF: In state or out of state TSDF landfill							

TABLE VIII-3 (Cont.)

Part 7: DFS Refractory

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0	0.27	NA	Solid	Inorganic	Permeable solid	F999	K907	D007, D008 (S)	Sporadic	Batches
TOCDF	0	<100	<100								
Total		<100.27	<100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	CAMDS: Permitted long-term storage TOCDF: <90-day storage on site	Off-site stabilization for metals as needed	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	CAMDS: May allow for future accumulati on at temporary satellite locations	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 8: Demilitarization Protective Ensemble (DPE) Suits

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	2.23	5.2	1	Solid	Organic,	Permeable	F999	K903	None	Routine	Routine
TOCDF	NA	< 100	< 100		inorganic	solid					
Total	2.23	< 105.2	< 101								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums	CAMDS: Permitted long-term storage on-site	CAMDS On-site thermal desorption	None	CAMDS Out of state TSDF landfill	Same	Same	Same	None	Same		Yes
	TOCDF: < 90 day storage, then permitted long-term storage in igloo	TOCDF None		TOCDF None (Storage only. Tests currently underway at CAMDS)							

TABLE VIII-3 (Cont.)

Part 9: Laboratory Liquid Wastes

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	2.13	1.09	0.21	Liquid, multiphasic	Organic, inorganic, corrosive, ignitable, pH, special handling (S)	Aqueous liquid, nonaqueous liquid	F999	K901, K904	D001 to D043 (S)	RRS, MMD: Sporadic	RRS, MMD: Batches
DUGWAY	NA	NA	NA								
RRS	0	0	0								
MMD	0	0	0								
TOCDF	NA	<100	<100							CAMDS, DUGWAY, TOCDF: Routine	CAMDS, DUGWAY, TOCDF: Routine
Total	2.13	<101.09	<100.21								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
Lab pack bags and 5- to 55-gallon drums	CAMDS: Permitted long-term storage on-site DUGWAY: < 90 days at generator location, then to permitted (< 1 year) storage on-site RRS, MMD, TOCDF: < 90 day storage inside, access to permitted storage	CAMDS: None TOCDF: Decontamination if above drinking water standards DUGWAY, RRS, MMD: Incineration off-site	None	CAMDS: None DUGWAY, RRS, MMD: Shipped off-site to a TSDF for incineration and disposal TOCDF: In or out of state TSDF landfill	Same	Same	CAMDS: Incineration on-site or off-site Others: Same	None	Same	Information may require updating periodically	Yes

TABLE VIII-3 (Cont.)

Part 10: Laboratory Solid Wastes

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	2.8	3.4	0.05	Solid (Some liquid possible)	Organic, inorganic	Permeable solid, nonpermeable solid	F999	K901, K902, K903	D001-D043 (S)	CAMDS, DUGWAY, TOCDF: Routine	CAMDS, DUGWAY, TOCDF: Routine
DUGWAY	NA	NA	4.2								
TOCDF	NA	< 100	< 100								
RRS	0	0	0								
MMD	0	0	0							RRS, MMD: Sporadic	RRS, MMD: Batches
Total	2.8	< 103.4	< 104.05								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
Bags or 15- to 55-gallon drums 3 x 3-foot fiberboard containers	CAMDS: Permitted long-term storage on-site RRS, MMD, TOCDF: < 90-day storage inside, access to permitted storage DUGWAY: < 90 day storage at the generation site, then transferred to < 1 year permitted storage on-site	CAMDS, RRS, MMD: None TOCDF: Decontamination in storage container at satellite storage location DUGWAY: Treated (if necessary) and disposed at out of state TSDF landfill	None	CAMDS: None DUGWAY, RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal. TOCDF: In state or out of state TSDF landfill	Same	Same	CAMDS: Incineration on-site or off-site	None	Same	Information may require updating periodically	Yes

TABLE VIII-3 (Cont.)

Part 11: Liquid Incinerator (LIC) Refractory

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
TOCDF	0	< 100	100 - 1000	Solid	Inorganic, possible TCLP metals	Permeable solid	F999	K907	D004 -D011 (S)	Sporadic	Batches
Total	0		100 - 1000								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	< 90 day storage	None	None	In state or out of state TSDF landfill	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 12: LIC Slag

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
TOCDF	NA	<100	100 - 1000	Solid	Inorganic, possibly TCLP metals	Permeable solid	F999	K907	D007 (S)	Periodic	Batches

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	< 90-day storage	Treated off-site only if characteristic	None	In state TSDF landfill	Same	Same	Potential for delisting if it does not contain characteristic wastes	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 13: Miscellaneous Metal Parts

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.56	0.5	0.5	Solid	Inorganic	Non- permeable solid	F999	K902	D004 - D011 (S)	TOCDF: Routine	TOCDF: Routine
DCD	NA	1	1								
DUGWAY	NA	NA	NA								
TOCDF	0	<100	<100								
RRS	0	0	0								
MMD	0	0	0							All Others: Sporadic	All Others: Batches
Total	0.56	<101.5	<101.5								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums, wooden crates, 4X4 boxes, rolloff boxes	DUGWAY, TOCDF, RRS, MMD: < 90-day storage inside CAMDS: DCD Permitted long- term storage	TOCDF: Incineration RRS, MMD: Shipped off-site to smelter CAMDS, DCD, DUGWAY: None	CAMDS, DUGWAY DCD: None TOCDF, RRS, MMD: Smelter	CAMDS: Out of state TSDF landfill DCD: In state TSDF landfill DUGWAY: Shipped off-site to TSDF	Same	Same	CAMDS: Smelter OTHERS: Same	CAMDS, RRS, MMD, TOCDF, DUGWAY: Smelter TOCDF: Trying to delist	None		Yes

TABLE VIII-3 (Cont.)

Part 14: Mist Eliminator Filters/Demister Candles

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.01	0	0	Solid	Organic,	Permeable	F999	K902, K903	D004 - D011	Sporadic	Batches
TOCDF	NA	0	< 100		inorganic	solid			(S)		
Total	0.01	0	< 100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums and rollofs	TOCDF: < 90-day storage CAMDS: Permitted long-term storage on-site	TOCDF: None CAMDS: Off-site stabilization for metals (if required)	None	TOCDF: In state or out of state TSDF landfill CAMDS: Out of state TSDF landfill	TOCDF: Same CAMDS: May allow for accumulation at temporary satellite locations	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 15: Metal Parts Furnace (MPF) Ash

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.73	1.75	0.36	Powdery solid	Inorganic	Permeable solid	F999	K906	D004 - D011 (S)	Sporadic	Batches
TOCDF	NA	<100	<100								
Total	0.73	<101.75	<100.36								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums	CAMDS: Permitted long-term storage on-site TOCDF: <90 day storage	Off-site stabilization for metals will be conducted (if required)	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	CAMDS: May allow for temporary storage at satellite locations	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 16: MPF Metal

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS TOCDF	144.32 NA	1.95 > 1000	7.87 > 1000	Solid	Inorganic	Non- permeable solid	F999	K902	D004 - D011 (S)	Sporadic	Batches
Total	144.32	> 1001.95	> 1007.87								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
4X4 boxes and rollofs	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site	CAMDS: None TOCDF: Incineration	CAMDS: None TOCDF: Smelting	CAMDS: Out of state TSDF landfill TOCDF: None	Same	Same	Both: Smelting	Both: Metal sent to smelter	Both: None (recycled)		Yes

TABLE VIII-3 (Cont.)

Part 17: MPF Refractory

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	3.8	0	0	Solid	Inorganic	Permeable solid	F999	K907	D004 - D011 (S)	Sporadic	Batches
TOCDF	NA	<100	<100								
Total	3.8	<100	<100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site	Both: Off-site stabilization for metals will be conducted (if required)	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	CAMDS: May allow for temporary storage at satellite locations TOCDF: Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 18: MPF Residue

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	NA	NA	NA	Solid	Inorganic,	Permeable	F999	K902, K903	D004 - D011	Sporadic	Batches
TOCDF	NA	< 100	< 100		possibly TCLP Metals	solid			(S)		
Total	NA	< 100	< 100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rolloff boxes	CAMDS: Permitted long-term storage TOCDF: < 90 days on-site	Both: Treated off-site if characteristic	No	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	Same	CAMDS: May allow for accumulation at temporary sites TOCDF: Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 19: Pollution Abatement System (PAS) Brine

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS TOCDF	442.5 NA	252.1 > 1000	192.4 > 1000	Liquid	Inorganic, pH	Aqueous liquid	F999	K908	D004 - D011 (S)	Routine	Routine
Total	442.5	> 1252.1	> 1192.4								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
Tanks	Both: Permitted long-term storage on-site	CAMDS: On-site thermal drying TOCDF: Evaporation in BRA	CAMDS: None TOCDF: Metals reclaimed and water discharged under NPDES	CAMDS: None TOCDF: (metals) In state or out of state TSDF landfill	Same	Same	Same	Same	TOCDF: If not characteristic, delisting may be attempted		Yes

TABLE VIII-3 (Cont.)

Part 20: PAS Brine Sump Sludge

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.446	0.26	0.25	Solids and liquids	Inorganic, pH	Aqueous liquid	F999	K908	D004 - D011 (S)	Sporadic	Batches
TOCDF	NA	< 100	< 100								
Total	0.446	< 100.26	< 100.25								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums and tank trucks	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site	Both: Off-site stabilization for metals will be conducted if required	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill	Same	CAMDS: May allow for accumulation at temporary (satellite) locations	TOCDF: On site volume reduction	None	TOCDF: Solids to in state TSDF landfill with BRA residue		Yes

TABLE VIII-3 (Cont.)

Part 21: PAS Quench Tower Residue

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
TOCDF	NA	<100	<100	Granular solid	Inorganic	Permeable solid	F999	K908	D004 - D011 (S)	Sporadic	Batches
Total		<100	<100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums	< 90 day storage on-site	None	None	In state or out of state TSDF landfill	Same	Same	None	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 22: Plastics

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.26	1.3	NA	Solid	Organic, inorganic	Permeable solid	F999, P999	K903	D004 - D011, D022, D028, D034, D039, D040, D043 (S)	CAMDS: Sporadic	CAMDS: Batches
DCD	NA	0.19	0.19								
DUGWAY	NA	NA	NA								
TOCDF	0	0	0								
	NA	< 100	< 100							DCD, DUGWAY, TOCDF: Routine	DCD, DUGWAY, TOCDF: Routine
Total	0.26	< 113.19	< 100.19								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	CAMDS, DCD, TOCDF: Permitted long- term storage on-site DUGWAY: < 90 day storage	TOCDF: Decontamination before placing in storage container Others: None	None	CAMDS: Out of state TSDF landfill DCD, DUGWAY: In state TSDF landfill TOCDF: Stored only until treatment/dispos- al method is determined	Same	Same	DUGWAY: May be mixed with liquids Others: Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 23: Residue Handling Area Baghouse Residue

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
TOCDF	NA	< 100	< 100	Powdery solid	Inorganic	Permeable solid	F999	K906	D004-D011 (S)	Routine	Routine

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	< 90 day storage on-site	None	None	In state or out of state TSDF landfill	Same	Same	None	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 24: Soil

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.29	3.7	0	Solid	Organic, Inorganic, corrosive	Permeable solid	P999, F999	Same as original contaminating waste	D004 - D011, D022, D028, D034, D039, D040, D043 (S)	DCD: Routine Others: Sporadic	DCD: Routine Others: Batches
DCD	0	1	1								
DUGWAY	NA	NA	NA								
RRS	0	0	0								
MMD	0	0	0								
Total	0.29	4.7	1.0								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	CAMDS, DCD, DUGWAY: Permitted long-term storage on-site RRS, MMD: < 90 day storage	None	None	CAMDS: Out of state TSDF landfill DCD: In state TSDF landfill DUGWAY, RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal	Same	Same	None	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 25: Spent Activated Carbon

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	1.9	2.25	3.37	Granular solid	Organic, inorganic (sometimes impregnated with NaOH and 10% phosphoric acid)	Permeable solid	F999, P999	K905	D007 (S)	DCD: Routine	DCD: Routine
DCD	NA	2.7	2.7								
DUGWAY	NA	NA	NA								
TOCDF	0	0	0								
RRS	NA	< 100	< 100								
MMD	0	0	0							Others: Sporadic	Others: Batches
Total	1.9	< 104.95	< 106.07								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
5- to 55-gallon plastic lined (double bagged) drums and 4X4 wooden boxes	CAMDS, DCD, TOCDF: Permitted long-term storage on-site DUGWAY, RRS, MMD: < 90 day storage, access to permitted storage	None	None	RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal in hazardous waste landfill Others: None	Same	Same	CAMDS: Incineration, either on site or off-site TOCDF: Possible micronization and incineration	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 26: Spent Hydraulic Fluid

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	1.8	0.6	0.24	Liquid,	Organic,	Nonaqueous	F999,	K904	D004 - D011	Sporadic	Batches
DUGWAY	NA	NA	NA	multiphasic	inorganic	liquid	P999		(S)		
TOCDF	NA	< 100	< 100								
Total	1.8	< 100.6	< 100.24								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums (phenolic lined)	CAMDS, DUGWAY: Permitted long-term storage TOCDF: < 90 day storage inside	CAMDS TOCDF: Incineration DUGWAY: None currently generated	None	CAMDS: Residue disposed in an out of state TSDF landfill TOCDF: In state or out of state TSDF landfill DUGWAY: None currently generated	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 27: Spent Silver Fluoride Pads

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	NA	NA	NA	Solid	Organic, inorganic	Permeable solid	F999, P999	K903	D001, D011 (S)	TOCDF, CAMDS, DUGWAY: Sporadic	TOCDF, CAMDS, DUGWAY: Batches
DCD	NA	NA	NA								
DUGWAY	NA	NA	NA								
TOCDF	NA	<100	<100								
Total	NA	<100	<100							DCD: Routine	DCD: Routine

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
5- to 20-gallon drums	DCD, CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site DUGWAY: None currently generated	None	None	CAMDS: Out of state TSDF landfill TOCDF, DCD: In state or out of state TSDF landfill DUGWAY: None currently generated	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 28: Spill Cleanup Material

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	0.74	1.45	NA	Solid, sometimes containing multiphasic liquids	Organic, inorganic, corrosive	Permeable solid	F999, P999	Code of spilled material	D001 - D011, D022, D028, D034, D039, D040, D043 (S)	Sporadic	Batches
DCD	0	1	1								
DUGWAY	NA	NA	NA								
TOCDF	NA	< 100	< 100								
RRS	0	0	0								
MMD	0	0	0								
Total	0.74	< 101.45	< 101								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post- UCAR Treatment	Post- UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	CAMDS DCD: Permitted long-term storage on-site DUGWAY, TOCDF, RRS, MMD: < 90 day storage inside	TOCDF: Incineration in MPF on-site as miscellaneous waste for limited types of materials. Others: Possible chemical neutralization	None	CAMDS: Out of state TSDF landfill DUGWAY, RRS, MMD: Shipped off-site to a TSDF for treatment and/or disposal DCD, TOCDF: In state or out of state TSDF landfill	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 29: Styrofoam

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes (Always (A) Sometimes (S))	Frequency of Generation	Generation Mode
CAMDS DUGWAY	NA NA	NA NA	NA NA	Solid	May contain corrosives	Permeable solid	F999	K903	D001 - D011, D022, D028, D034, D039, D040, D043 (S)	Sporadic	Batches
Total	0	0	0								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	Permitted long-term storage on site	None	None	DUGWAY: Ship off-site to a TSDF for treatment and/or disposal CAMDS: Out of state TSDF landfill	Same	Same	Same	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 30: Trash, Debris, and Protective Clothing

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	15.8	20.35	6.25	Solid	Organic, inorganic and corrosives	Permeable solids, nonpermea- ble solids	F999, P999	K903	D001 - D011, D022, D028, D034, D039, D040, D043 (S)	CAMDS, RRS: Sporadic	CAMDS, RRS: Batches
DCD	NA	10	10								
DUGWAY	NA	NA	NA								
TOCDF	NA	< 100	< 100								
RRS	0	0	0								
MMD	0	0	0							DCD, DUGWAY, TOCDF: Routine	DCD, DUGWAY, TOCDF: Routine
Total	15.8	< 130.35	< 116.25								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	CAMDS, DCD, TOCDF: Permitted long- term storage on-site	TOCDF, RRS, MMD: Decontamination before placing in storage container	RRS, MMD: Uncontaminated pigs may be recycled to a smelter	CAMDS: Out of state TSDF landfill	Same	Same	RRS, MMD: Incinerated ash to be disposed at TSDF landfill (may be stabilized first)	Same	Same		Yes
	DUGWAY, RRS, MMD: < 90 day storage on-site, access to permitted storage	CAMDS DCD DUGWAY: None		DCD: In state TSDF landfill			Others: Same				
				DUGWAY, RRS, MMD: Shipped offsite to a TSDF for treatment and/or disposal							
				TOCDF: None							

TABLE VIII-3 (Cont.)

Part 31: Waste Oil

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	NA	NA	NA	Liquid	Organic	Nonaqueous liquid	F999, P999	K904	Unknown	Sporadic	Batches
DUGWAY	NA	NA	NA								
TOCDF	NA	< 100	< 100								
Total		< 100	< 100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
5- to 55-gallon drums	CAMDS: Permitted long-term storage on-site TOCDF: < 90 day storage on-site DUGWAY: None - not currently generated	TOCDF: Incineration Others: None	None	CAMDS: Out of state TSDF landfill TOCDF: In state or out of state TSDF landfill DUGWAY: None - not currently generated	Same	Same	CAMDS: May be incinerated in LIC furnace TOCDF: Incineration	None	Same		Yes

TABLE VIII-3 (Cont.)

Part 32: Water/Aqueous Solutions

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
DCD	0	0	NA	Liquid	Inorganic	Aqueous	F999,	K904	Unknown	Sporadic	Batches
DUGWAY	0	0	1000			liquid	P999				
Total	0	0	1000								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
55-gallon drums or rollofs	Permitted long-term storage on-site	None	None	DCD: In state TSDF DUGWAY: None	Same	Same	DCD: May be delisted based on risk-based decisions	DCD: May be returned to NPDES based on risk-based decision	Same		Yes

TABLE VIII-3 (Cont.)

Part 33: Wooden Pallets

Generators	1993-1995 Waste Volume (tons)	1996 Waste Volume (tons)	1997 Waste Volume (to date) (tons)	Physical Characteristics	Chemical Characteristics	Matrix Category	Current Waste Agent Code	Proposed Agent Waste Code	Applicable D Codes [Always (A) Sometimes (S)]	Frequency of Generation	Generation Mode
CAMDS	NA	NA	NA	Solid	Organic	Permeable solid	F999, P999	K903	D001 - D011, D022, D028, D034, D039, D040, D043 (S)	Sporadic	Batches
DCD	NA	NA	NA								
DUGWAY	NA	NA	NA								
TOCDF	NA	< 100	< 100								
RRS	0	0	0								
MMD	0	0	0								
Total	NA	< 100	< 100								

Current Storage	Typical Current Storage Time	Current Treatment	Current Recycling	Current Disposal	Post-UCAR Storage	Post-UCAR Typical Storage Time	Post-UCAR Treatment	Post-UCAR Recycling	Post-UCAR Disposal	Comments	Data Complete
15- to 55-gallon drums	CAMDS, DCD, TOCDF: Permitted long- term storage RRS, MMD, DUGWAY: < 90 day storage inside, access to permitted storage	Under development	None	CAMDS: Out of state TSDF landfill DCD: None RRS, MMD, DUGWAY: Shipped off-site to a TSDF for treatment and/or disposal TOCDF: Storage until treatment/disposal method determined	Same	Same	Same	None	Same	Information may require updating periodically	Yes

See Notes and Sources on Next Page

TABLE VIII-3 (Cont.)

^a Table Notes:

- Waste volumes are approximations and in some cases represent estimation from density information.
- NA means information was not available.
- In some cases, both in state or out of state waste management facilities can be utilized. Decisions as to off-site management are sometimes conducted by the Army Defense Reutilization and Marketing Office (DRMO).

Sources: U.S. Army (1995, 1997a); TOCDF (1997).

that the nonwastewater category be further subdivided into nonwastewater liquids and nonwastewater solids. Additional justification for this proposed further subcategorization of the nonwastewater category is provided in Section IX.F of this Preamble. The following discussion reviews each of the "K" wastes and defines them in terms of whether they are considered wastewaters, nonwastewater liquids, or nonwastewater solids:

- **K901:** Spent chemical neutralization fluids are proposed to be defined as either wastewaters or nonwastewater liquids, depending on their TOC and TSS content. As indicated above, spent chemical neutralization solutions can contain organic elements, including breakdown products of the agents, and may also contain suspended solids. While some chemical neutralization fluids may fall under the EPA definition of a wastewater, because of their suspended solids content, DSHW believes that some spent chemical neutralization fluids may fall under the definition of a nonwastewater.
- **K902 and K903:** Permeable and nonpermeable solids are proposed to be defined as nonwastewater solids for the purposes of LDR designation.
- **K904:** These liquid wastes can be aqueous or organic in nature, may consist of a combination of organic and aqueous components, and may also contain suspended solids. While some K904 wastes may fall under the EPA definition of a wastewater, DSHW believes that because of their organic or suspended solids content, some K904 wastes may fall under the definition of a nonwastewater. K904 wastes are proposed to be defined as either wastewaters or nonwastewater liquids, depending on their TOC and TSS content.
- **K905:** This waste, spent carbon, is defined as a nonwastewater solid for purposes of LDR designation.
- **K906 and K907:** These waste streams consist of slag and ash from incineration activities. They are proposed to be defined as nonwastewater solids for purposes of LDR designation.
- **K908:** This group consists of brine salts, liquids, solids, and sludges generated from pollution abatement. While it is clear that brine solids and most sludges will be defined as nonwastewater solids, the liquids could qualify as wastewaters. Because of the high salt content of these liquids, DSHW proposes to include them in the nonwastewater liquid category.

DSHW notes that generators may remove liquids from nonwastewater liquids by various means such that they are classified as nonwastewater solids. Brine liquids and sludges, for example, are often dewatered (e.g., at TOCDF) to produce brine salts.

Additional information regarding wastewater-nonwastewater differentiation is provided in Preamble Section IX.F.

C. EFFECT OF LISTING ON SPECIFIC RESIDUES

The information in this section is intended to clarify applicability of the "K" waste listings to individual waste streams.

1. Mixture and Derived-From Waste

In accordance with 40 CFR 261.3(a)(2)(iv), which is adopted by DSHW in R315-2-3, the combination of a listed waste ("P", "U", "F", or "K") with a solid (nonhazardous) waste or a characteristic waste results in the entire waste's being defined as the listed waste. This provision is referred to as "the mixture rule." The mixture rule applies to the "K" wastes proposed in today's rule, as it would any other waste. Any solid waste mixed with a "K" waste makes the entire waste the "K" hazardous waste. The mixture rule is reviewed in Section V of this Preamble.

In accordance with 40 CFR 261.3(c)(2)(i), which is adopted by DSHW in R315-2-3, solid waste that is generated from the treatment, storage, or disposal of a hazardous waste is itself classified as the listed hazardous waste. This provision is referred to as "the derived-from rule." In accordance with this rule, residues resulting from treatment, storage, or disposal of a listed hazardous waste, including sludges, ashes, emission control dusts, leachate, spill residues, etc., are considered to be the listed hazardous waste. The derived-from rule applies to the "K" wastes proposed in today's rule, as it would any other waste. The derived-from rule also is reviewed in Section V of this Preamble.

The exemption proposed in today's rule (see Preamble Section XII), provides that such mixtures and derived-from waste could be exempted from RCRA controls if the concentration of the hazardous constituents (e.g., agents) in the waste stream is below exemption levels. However, the LDR provisions, which DSHW has adopted in R315-13, provide for a prohibition on dilution. Listed waste may not simply be diluted with nonhazardous wastes or characteristic wastes to meet LDR (or exemption level) requirements.

Historically, EPA's mixture and derived-from rules have been the source of much controversy and confusion. These rules, originally promulgated by EPA in 1980, were remanded in 1991 by the courts. In 1992, however, the rules were reinstated on an interim basis and, as of today's proposed rule, remain in effect on an interim basis. The controversy stems from the fact that many mixture or derived-from wastes truly do not pose a hazard to human health and the environment; they contain a fraction of the hazardous component of the original hazardous waste and, in many cases, do not even resemble the original hazardous waste. EPA attempted to resolve the problem through its proposed Hazardous Waste Identification Rule for Process Wastes (HWIR) (60 FR 66344, December 21, 1995). Specifically, EPA proposed to establish exit levels for hazardous waste constituents, below which the waste would no longer be considered hazardous waste. The HWIR proposed rule has itself been steeped in controversy, and EPA does not anticipate finalization of the rule until 2001. The HWIR rule is discussed in Section V of this Preamble.

While the mixture and derived-from rules will remain in effect for the proposed agent waste listings, DSHW, for all practicable purposes, is minimizing the applicability of these rules through its proposed manner of listing the "P" and "U", and the "K" wastes and through the establishment of the exemption levels.

2. Scrap Metal, Including Munition Bodies and Bulk Containers

Recyclable materials that may be associated with chemical agents or wastes consist primarily of metals, but may also include glass, ceramics, or other materials. Of primary concern to the Army is scrap metal. Scrap metal is expected to be produced during demilitarization activities.²³ Scrap metal may also be produced under a number of other activities, including testing operations at DPG, during research and development activities at CAMDS, and as a consequence of installation restoration programs or unit closures.

Under the RCRA regulations, as adopted by DSHW, scrap metal is defined as a RCRA solid waste. If the scrap metal "contained" a listed hazardous waste, the scrap is also defined as the listed hazardous waste. As proposed today, scrap metal would be defined as K902. Even if the scrap metal is or has been contaminated with other materials, such as spent chemical neutralization fluids (K901), it would be defined as K902.

²³ Drained munition bodies, spray tanks, and bulk containers are considered as falling under the definition of scrap metal (See 40 CFR 261.1, as adopted in R315-2-2).

Under 40 CFR 261.6(a)(3), scrap metal that is solid and hazardous waste is excluded from regulation under 40 CFR Parts 262 through Parts 266 or Parts 268, 270 or 124 (as adopted in DSHW regulations), as long as it is recycled. Hence, scrap metal that is identified as a "K" waste would be exempt from all substantive RCRA requirements (e.g., generator standards, manifesting, permitting, LDRs, etc.), as long as it is recycled. If the scrap metal is not recycled, then all of RCRA becomes applicable. Obviously, EPA has determined that scrap metal has some intrinsic value and should be recycled. The EPA regulations clearly promote scrap metal recycling.

The benefits of being able to recycle scrap metal are significant. First, the scrap may be sold to scrap dealers, thereby reducing the cost of demilitarization. From an environmental and resource recovery perspective, there are obvious benefits from recycling whatever can be recycled, especially considering that wastes that are not recycled typically end up taking up space in a hazardous waste landfill.

Regardless of all these considerations, DSHW is concerned about safety. Specifically, DSHW is concerned that some scrap metal (e.g., munition bodies and bulk containers) may contain residual levels of chemical agent that could harm workers at recycling facilities. On July 29, 1996, DSHW issued a directive to the Army that required manifesting scrap metal as F999 hazardous waste and imposed requirements on the receiving smelter as well. While this requirement is clearly outside the scope of EPA regulations, which Utah has adopted, DSHW believed it had the authority to regulate activities that EPA does not regulate when determined to be necessary to protect human health and the environment. The Army has recognized such requirements as being outside the scope of EPA and DSHW regulations, but has determined that it would comply nonetheless. Currently, the Army is in compliance with these non-regulatory-based requirements.

DSHW believes that agent associated scrap metal should be recycled, the most environmentally acceptable disposition alternative. DSHW is proposing to defer to EPA's regulatory framework for scrap metal, as identified in 40 CFR 261.6 (adopted by DSHW in R315-2-6). DSHW is withdrawing the controls identified in the 29 July 1996 directive. DSHW believes that this action is especially appropriate considering the Army's existing AR 385-61 requirements (described in Preamble Section III).

Another provision of RCRA that could be applied to munition bodies and bulk containers is that prescribed for empty containers. EPA's requirement for determining if containers are empty may be found in 40 CFR 261.7 (adopted by DSHW in R315-2-7). In accordance with this regulation, a container or inner liner removed from a container that has held an acute hazardous waste (e.g., a "P"

chemical), is empty if it has been triple rinsed with a solvent capable of removing the chemical, or it has been cleaned by another method that has been shown to achieve equivalent removal, or, in the case of the container, the inner liner that prevented contact of the chemical with the container has been removed. Most important, while empty containers are defined as solid waste under RCRA, they are not defined as hazardous wastes, and they carry no hazardous waste code. This situation differs from the regulation of scrap metal, as described above. The empty container, or any residue remaining in the empty container, is not subject to 40 CFR Parts 261 through Parts 265 or Parts 268, 270 or 124. While empty containers may also be interpreted under RCRA as "solid waste" scrap metal, they are not defined as "hazardous waste" scrap metal (because they are empty, they contain no hazardous waste).

DSHW has evaluated the empty container option and believes that if a container is truly empty, then hazardous waste regulations are inappropriate. However, the triple rinse process, or an alternative, has not been demonstrated as being effective for munition bodies or bulk containers. CAMDS is currently in the process of demonstrating that thermal treatment of the containers is equivalent to triple rinsing, but this demonstration is not yet complete. DSHW also notes that the process of triple rinsing the containers is not defined as hazardous waste treatment; hence no permit is required for this activity. However, if the Army seeks an alternative to triple rinsing, as identified in 40 CFR 261.7, such activity, depending on its nature, may require a hazardous waste permit. DSHW will reevaluate the empty container option when the Army successfully demonstrates that triple rinsing or an alternative is effective.

Another option for management of agent associated scrap metal, under K902, is to define these materials a hazardous debris. The debris rule includes special, simplified, LDR treatment standards for hazardous debris (57 FR 37194). The advantage of the hazardous debris approach is that LDR standards for materials that can be defined as hazardous debris are much reduced. In many cases, extraction or destruction technologies can be used to meet LDR standards, which results in removal of the listed waste code (i.e., the debris are no longer hazardous waste). Management of scrap metal as hazardous debris is allowed under current LDR regulations, as adopted by DSHW under R315-13. Additional details of applying this approach are discussed in Preamble Section IX.D.

3. Remediation Waste

DSHW expects that the ongoing remediation of old agent associated waste disposal sites in Utah, primarily at DPG and the DCD, may result in the generation of various types of agent associated wastes. The term "generate" here is important because, in the remediation sense and in the vast majority of cases,

chemical agent associated waste will not be generated until contaminated media are exhumed. Further, if contamination at the site is conducted in situ (e.g., bioremediation), no waste is considered to have been generated. In this case, waste management standards, including LDRs, do not apply. In addition, Corrective Action Management Units (CAMUs) may also be used to manage remediation waste; LDRs do not apply here either (see 40 CFR 264.552). Of course, corrective measures at RCRA units, which are determined by DSHW, must also be protective of human health and the environment. In situ management, CAMUs, and other options will only be implemented if they are determined to be protective of human health and the environment.

It is DSHW's preference that remediation, if necessary, be conducted in situ. However, if this is not possible, and other alternatives are considered, it is likely that these alternatives will involve generation of wastes. Several different types of wastes may be generated as a result of remediation activities, including contaminated media and debris, munition items, and CAIS sets. The disposition of each of these types of remediation wastes is discussed briefly below.

Contaminated media and debris are affected by the "contained-in" principle (discussed in Section V of this Preamble). The "contained-in" principle was an interpretive principle for the mixture and derived-from rules (discussed above), which declared that environmental media, such as soil and groundwater, that have been contaminated with a listed hazardous waste must be managed as hazardous waste until the media are determined to no longer contain the hazardous waste. The contained-in principle was codified at 40 CFR 268.45(a) and 40 CFR 261.3(e)(2). As a result, debris that no longer contains a listed hazardous waste would not be subject to Subtitle C regulation, provided that it does not exhibit a RCRA characteristic. As indicated above, the debris rule included special, simplified, LDR treatment standards for hazardous debris (57 FR 37194). DSHW has adopted the debris rule (R315-13), and its provisions apply to contaminated media as well. Section V of this Preamble contains additional information on the contained-in principle and the debris rule.

Contaminated media and debris could potentially end up being a high-volume remediation waste. However, considering the relative lack of persistence of the chemical agents, the DSHW is doubtful that significant amounts of the chemical agents will be found consistently at old disposal sites, especially since most of the disposal sites have existed for many years. Any agent that was initially present would be expected, in general, to have degraded long ago. The one possible exception to this may be H/HD; bulk quantities of H/HD can persist in soil or surface water environments for extended periods. However, upon eventual dissolution into the water phase, H/HD will hydrolyze rapidly (see Background Document B and Appendix E of Background Document E for details). It is unlikely

that old waste disposal sites will contain bulk HD; the more likely scenario would be the presence of waste chemical neutralization residues.

One of the more significant concerns for old agent disposal sites is agent breakdown products. However, only two of the agent breakdown products are of concern from a toxicological standpoint — EA2192 (a breakdown product of VX) and LO [a breakdown product of lewisite (including CVAA, the hydrated form of LO)]. The breakdown products of the other agents are relatively innocuous but have nonetheless been considered in today's proposed rule as indicators of groundwater monitoring programs. The DSHW therefore believes that most potentially contaminated media will turn out to be contaminated, if at all, at low levels. If such is indeed the case, no (or very little) active remediation will be needed, and, hence, no (or very little) contaminated media or debris will be generated. Whatever media are exhumed, however, in accordance with the derived-from rule, will be identified by the original waste code(s) of the waste(s) suspected of contaminating the media in the first place.

During the process of active remediation, it is possible that munition items, such as bombs, land mines, or bulk containers, could be found in the field. Some of these items will be explosively configured, and others will be nonexplosively configured. The Army's MMD-1 (Munitions Management Device-1) is intended to be used in the field to effectively neutralize the chemical agent present in these items. This device is limited, though, to nonexplosively configured munitions. A RCRA RD&D permit for use of the MMD-1 is under development. The Army is also working on a second generation MMD that is intended to address explosively configured munitions.

CAIS may also be exhumed during remediation. These sets were described in Preamble Section VII. Agents contained in buried munition items and CAIS are not part of the U.S. stockpile. The Army intends to treat these materials through the RRS, as explained earlier. The agents contained in CAIS are considered hazardous waste upon their exhumation, and DSHW is proposing that these wastes be identified as commercial chemical products. "P" and "U" codes will therefore be applied to these materials as they are exhumed during remediation activities.

4. Testing Activities

The K901, K902, and K903 process waste categories apply to the appropriate material after such material has been classified as solid waste. This distinction is important because at places like DPG and CAMDS, the Army conducts testing of chemical agents, protective equipment, chemical neutralization procedures, etc. In these cases, waste is not generated until after the test is completed. For example, the test often includes chemical neutralization and

examination of the chemical neutralization fluid and the neutralized materials for various parameters. Hence, in these cases, when the K902 and K903 materials become wastes (after the test is completed), they have already been neutralized. In such instances, the K902 and K903 waste streams, as well as the K901 waste stream, meet LDR standards as generated. (See Preamble Section IX for details.)

5. Unknowns

In years past, chemical munitions or chemical agent associated waste have been found in or on the land at various military installations (and in very rare cases, off military installations). Once excavated, these munitions would be characterized. Since the agent within the munition is (or once was) pure or nearly pure, the munition would assume the "P" or "U" waste code of whatever chemical is contained. Any material that could be identified as a mixed-with or derived-from waste (e.g., contaminated soil) in this case would be identified as the "P" or "U" waste. If, however, a old agent associated waste disposal area is identified as having received spent chemical neutralization fluids (proposed K901), any mixed-with or derived-from waste (e.g., contaminated soil, leachate) would be defined as the corresponding "K" waste. Note, that in both cases, waste is not generated until the contaminated medium is exhumed.

In some cases, buried munitions on which the markings have worn away may be located at military installations. Although in most cases the military's munitions experts will be able to tell (from examining records, item configuration, etc.) what the item is and what, if any, chemicals are contained within it, in some cases the identity of the munition will be initially unknown. In such cases, additional examination will be needed to determine the item content. While such items are being characterized, and up to the time where chemical identity is determined, the chemical content (if any) of the item will be unknown. Other situations may also occur when the chemical nature of potential agent associated materials is initially unknown. Especially for chemical agent associated wastes, it is important to know the identity of the chemical so that proper safety precautions can be taken and proper waste management procedures can be identified. The Army will, therefore, use all means appropriate to identify the chemical. A "P" or "U" code will be assigned to chemical munitions, or if appropriate, a "K" code will be assigned to associated wastes, as soon as the nature of the waste is determined. The listing does not "attach" (no waste is generated) until the waste is identified. Up until this time, the item is managed in strict compliance with Army regulations and implementing guidance, as indicated in Section III of this Preamble.

DSHW notes that the same situation often faces private industry, where, for example, unlabeled drums of chemicals or waste may be located in an old building or the corner of a basement. In this case as well, a hazardous waste determination

is not made and a pertinent waste code (if any), is not assigned until the contents of the drum are determined.

6. Small-Quantity Exclusion

As indicated in Preamble Section VI, waste streams produced by the Army may sometimes be of small quantity and short duration. The combination of waste characteristics and small quantity, coupled with specific engineering or other management controls, may reduce to negligible levels the probability of risk to human health and the environment. DSHW is therefore proposing to incorporate a small-quantity exclusion into today's proposed rule for such cases. To qualify for this exclusion, the Army must demonstrate that the level of protectiveness that is reasonably expected to be obtained by alternative controls will functionally meet or exceed those intended and prescribed by the provisions described in today's proposed rule. Waste streams that are otherwise hazardous (i.e., are federal listed wastes or exhibit a characteristic) will not qualify for this exclusion.

The Army must apply to DSHW to obtain this small-quantity exclusion. The same requirements for rulemaking petitions described in R315-2-16 (e.g., delisting) apply herein. DSHW has decided not to place limits in today's proposed rule on actual quantities of wastes that would qualify for exclusion, but will instead evaluate petitions on a case-by-case basis. The Army must demonstrate, however, that the level of protectiveness reasonably expected to be obtained by alternative controls will functionally meet or exceed the level of protectiveness provided by the provisions described in today's proposed rule.

IX. LAND DISPOSAL RESTRICTIONS

The proposed Utah Chemical Agent Rule (UCAR) has three basic components: relistings, land disposal restrictions (LDRs), and exemptions. This section discusses LDRs, focusing on the technology-based standards proposed for the LDRs. Development of the LDR concentration-based standards (concentrations for individual constituents) is discussed in detail in Preamble Section XI. In accordance with today's proposed rule, the generator would have the option of applying the concentration-based LDR standards or one of the technology-based standards. Technology-based versus concentration-based standards are discussed below in Section IX.A.2. Both are developed on the basis of a determination of health risk, as described below.

A. GENERAL APPROACH

Once a waste has been determined to be hazardous, it must be disposed of in accordance with the LDR regulations. Specifically, wastes must be treated to comply with specified treatment standards before land disposal. These treatment standards are designed to substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste.

1. BDAT vs. Health-Based Approach

The U.S. Environmental Protection Agency's (EPA's) LDR program, which is outlined in 40 CFR 268, has been adopted by DSHW under R315-13. Under EPA's LDR program, treatment standards are developed on the basis of the best demonstrated available technology (BDAT). Standards are established for each hazardous constituent in each class or type of waste stream. Most of the numerical BDAT standards that EPA has established are in the parts per million (ppm) or parts per billion (ppb) range, but again, they are based on technology, not risk. The RCRA statute [as amended by the Hazardous and Solid Waste Amendments (HSWA)] permits the establishment of LDR standards based on BDAT or risk. Because EPA's standards are based on BDAT, these treatment standards can be established at levels above or below those that are actually necessary to protect human health and the environment. They are simply based on the best demonstrated treatment.

The "available" aspect of EPA's BDAT definition relates to whether the technology is commercially developed and, further, whether there is capacity, either commercial or on-site, to treat waste generated at individual facilities.

The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has already stated, in Section II of this Preamble, that it intends to develop the UCAR on the basis of potential risk that a release of a substance would pose to human health and the environment. This intention was the second stated principle behind today's proposed rule. DSHW has therefore decided to deviate from EPA's approach in this regard. Hence, LDR standards proposed today are not based on BDAT; they are instead based on health risk. Technologies that are capable of treating agent associated wastes must, however, still be "available" to treat the waste in question. Availability is discussed below in Section IX.F.

2. Technology vs. Concentration-Based Standards

Once the general approach for developing LDR levels is established (i.e., a health-risk-based approach), treatment standards can be set in two different ways because there are two different types of LDR treatment standards: technology based and concentration based. When a technology-based standard applies, wastes must be treated by that technology (e.g., incineration). When a concentration-based standard applies, wastes must be treated to meet concentration limits established for individual constituents. The primary advantage of the technology-based standard is that wastes do not need to be analyzed to prove that treatment standards have been met. The primary advantage of the concentration-based standard is that the facility has latitude to determine the most appropriate technology to apply to treat the waste, including emerging and innovative technologies.

An innovative approach has been established with respect to these standards in today's proposed rule. Specifically, both technology- and concentration-based standards are proposed for the same listed waste streams, with generators being given the option of determining, for specific listed wastes, which standard would be applied. While the concentration-based standards are based directly on risk (i.e., they are developed from application of the human health risk assessment), the identified LDR technologies must nevertheless meet the concentration-based numbers as a condition of their being proposed in today's rule. The demonstration that the technologies are capable of meeting the concentration-based standards is made as part of today's proposed rule. In this manner, regardless of which option is chosen by the Army for application to a specific waste stream, protection of human health and the environment is ensured.

The primary advantage of this approach is that when the technology-based standard is applied, repeated and expensive analyses are avoided. When emerging and innovative technologies become available, the rule would permit their use as long as the concentration-based standards are met.

3. Analytical Considerations

Exemption levels proposed in today's rule are at lower concentrations than the LDR concentration-based standards also proposed today (see Preamble Section XI). This difference is appropriate because the exemption levels are based on a more conservative risk assessment than are the LDR concentration-based standards. In essence, and in accordance with the approach outlined above, agent associated waste streams would only need to be analyzed when the Army believes that the wastes, either as generated or as a result of LDR treatment, meet established exemption levels. Alternatively, if the Army believes that a waste would meet LDR treatment standards, but that it would not be able to demonstrate that the waste meets exemption levels, the Army would in all likelihood decide to apply the LDR treatment technology, whereby no analyses are required.

If the Army decides to apply an emerging technology to meet LDR standards, analyses would be required to demonstrate that the technology meets the concentration-based LDR standards. Of course, if the emerging technology is capable of treating wastes to below the proposed exemption levels, the analyses would be targeted at the exemption levels rather than the LDR concentration standards.

An additional consideration with respect to analytical methods, as indicated in Section XII of today's Preamble, is that analytical methods must be sufficiently sensitive to detect concentrations at the appropriate level (the LDR concentration-based standards or the exemption levels) proposed in today's rule. However, there may be individual waste matrices that interfere with analytical methods, such that detection at LDR or exemption levels cannot be achieved. In this case, and in accordance with the provisions of today's proposed rule, generators would be required to apply the LDR technology-based standard, and the waste would not qualify for exemption. Generators could, however, subsequently modify their analytical methods, or develop new methods, to overcome these types of problems. If and when this happens, generators would be able to apply the concentration-based standard, and the waste would then qualify for the exemption.

B. LAND DISPOSAL RESTRICTIONS — TECHNOLOGY-BASED STANDARDS

1. Qualifications for Acceptable Technologies

As indicated above, DSHW is today proposing a health-risk-based approach to the establishment of LDR standards. This approach applies to both the concentration-based standards and the technology-based standards. The concentration-based standards proposed today are based directly on risk. The

primary condition that the acceptable technologies must meet is that they be able to attain the concentration standards. In so doing, these technologies, once applied, would be protective of human health and the environment. Routine analyses of treated residues would not be necessary to demonstrate that the concentration standards have been met.

Three ways can be used to demonstrate that technologies are capable of meeting the LDR health-based standards:

- Physical/chemical discussion;
- Performance of bench-scale, pilot-scale, or full-scale studies; and
- Transference of data from one or more chemicals to chemicals (for which there are no or limited data) that are similar in terms of their physical and chemical properties.

DSHW believes that physical/chemical discussion as to why a treatment technology should work (or does work) provides supporting justification for application of a technology as an LDR technology, but will require either actual data demonstrating that the technology is capable of attaining the LDR concentration-based standards or application of technology performance data from one or more chemicals to other chemicals (for which data are not available) that are similar in terms of their physical and chemical properties. Data are rarely available for every combination of constituent and waste type or matrix. For example, EPA relied on the establishment of treatability groups and transferring of available data from one or more constituents or waste types to other constituents or waste types within the treatability group for which there were no data. DSHW, therefore, believes that technologies should be tested with representative constituents and waste types, and that these data can be used to support application of the technology to similar constituents and waste types.

DSHW expects that technologies would be tested in a bench- or pilot-scale study before being developed in a routine application. This evaluation will typically be accomplished through a treatability study or a research, development, and demonstration (RD&D) permit.

2. Proposed Technologies

The Army has provided data and information to the DSHW on two waste treatment technologies that have been demonstrated to meet the LDR concentration standards. These technologies are incineration and chemical

neutralization. In each case, the Army has developed for use by DSHW a background document that provides the required demonstration. Incineration is demonstrated in Background Document H and chemical neutralization is demonstrated in Background Document I. These background documents are provided in the Administrative Record that supports today's proposed rule. Also included within the Administrative Record are copies of key original documents that are referenced within the background documents.

Either of these technologies may be applied for treatment of all hazardous constituents addressed in this proposed rule, with the exception of DM (U901) and BZ (U902). These chemical agents only have the potential to be present at Dugway Proving Ground, where small amounts may be used for research and testing purposes. Also, due to lack of appropriate toxicological data and lack of data on similar chemicals, neither are there LDR concentration-based standards for DM or BZ. DSHW expects that the Army would pursue the small-volume exclusion (see preamble Section VIII.C.6) for these chemicals.

a. Incineration

Incineration is one of the most commonly employed technologies for the treatment of organic hazardous constituents, such as the chemical agents. In fact, most of EPA's LDR standards for organic hazardous constituents are based on incineration technologies. Waste matrices containing organic hazardous constituents are subjected to high temperatures, which break down the hazardous constituent into basic chemical components. The Army has employed the incineration technology for many years to destroy chemical agent. Incineration is the primary technology used by the Army at TOCDF and CAMDS. Incineration is conducted in units that are operated in accordance with the technical operating requirements of 40 CFR Part 264, Subpart O and in 40 CFR 265, Subpart O (adopted under R315-8-15 and R315-7-22, respectively), and as specified in the facility permit. This technology has been proven for all proposed "P" chemicals.

DSHW therefore proposes this technology for treatment of all proposed "P" chemicals and all listed process waste streams (K901 through K908), where applicable. DSHW notes that other technologies may be used by the Army for the "P" and "K" listed waste streams, as identified below, but incineration is nevertheless proposed to be approved for all of them.

Some incinerated materials (e.g., scrap metal) may be reused or recycled. Incineration residues, including those described under proposed K906, and K907, may be land disposed in a permitted hazardous waste landfill. If and when these residues meet the proposed exemption levels, they will no longer be subject to regulation as a hazardous waste under Utah hazardous waste management rules.

Further treatment to meet federal LDR standards is required, however, if the residuals exhibit any of the RCRA characteristics, as adopted in R315-2-9.

b. Chemical Neutralization

Chemical neutralization, often called chemical decontamination or decon, is chemical oxidation and/or hydrolysis by the following reagents or combination of reagents, sometimes in combination with simple alcohols or other solvents:

- Hypochlorite (e.g., bleach, super tropical bleach (STB), high-test hypochlorite (HTH));
- Sodium hydroxide; and/or
- Sodium carbonate.

In addition, approved neutralization fluids include other oxidizing or hydrolyzing agents of sufficient efficiency, in combination with organic solvents if appropriate, performed in units operated such that the agent, a surrogate compound, or an indicator parameter has been substantially reduced in concentration in the residuals to meet the LDR concentration standards.

Chemical neutralization, in some cases, will not require an operating permit under the Utah Hazardous Waste Management Rules. For example, some of the provisions of 40 CFR 262.34, as adopted by DSHW under R315-5-10, exempt treatment from permitting requirements if such treatment is conducted on-site in tanks or containers.²⁴ Otherwise, chemical neutralization will be conducted in units that are operated in accordance with the technical operating requirements of 40 CFR Part 264, Subpart X, and in 40 CFR 265, Subpart Q (adopted under R315-8-16 and R315-7-23, respectively), and as specified in the facility permit.

The Army has employed the chemical neutralization technology for many years to decontaminate various materials of chemical agent. This technology has been proven for all proposed "P" chemicals and all listed process waste streams (K901 through K908), except as noted below. It is therefore proposed as an LDR technology.

While K901 consists of spent chemical neutralization solution, waste streams K902 and K903 consist of nonpermeable and permeable materials,

²⁴ See also 51 FR 10168, March 24, 1986, EPA Memo 9441.1986(89), December 2, 1986, EPA Memo 9453.1987(08), December 15, 1987, and EPA Memo 9522.1988(04), November 2, 1988.

respectively, that can be neutralized (K902 and K903 can also be incinerated). The K901 waste stream is therefore a listed waste that is a residue from the chemical neutralization process. This waste stream meets LDR requirements as generated, with exceptions noted below, and may therefore be land disposed in a permitted hazardous waste facility.

Similarly, when treated by chemical neutralization, waste streams K902 and K903 are also residues from the chemical neutralization process. DSHW expects that these waste streams may qualify for the proposed exemption as generated. If they do not qualify for the exemption, the waste streams may be further treated in an effort to meet exemption levels. Such treatment would not be LDR driven, but may otherwise employ LDR technologies, such as incineration. Because they are still hazardous wastes at this point, though, any further treatment would be required to be conducted at a permitted TSDF. In addition, some chemically neutralized materials (e.g., scrap metal) may be reused or recycled.

In specialized applications, the Army has developed more complex neutralization materials, such as those used as part of the Army's Rapid Response System (RRS) to destroy agents contained within CAIS [e.g., 1,3-dichloro-5,5-dimethylhydantoin (DCDMH) in a mixture of chloroform, t-butyl alcohol, and water] and those used as part of the MMD to destroy agent in nonstockpile chemical munitions. Also included within this category is the Army's planned chemical neutralization process for lewisite. DCD's entire stockpile of lewisite, 10 ton containers, will be destroyed at CAMDS through a neutralization process originally developed in 1991 by Chem-Security Ltd. to destroy the Canadian stockpile of lewisite. Lewisite is converted to sodium arsenate in a three-step batch process. CAMDS has already received a RCRA RD&D permit for this process, with operation scheduled to begin in early 1999.

Spent neutralization solutions from the RRS and MMD, and from neutralization of lewisite, are included under the K901 listing. However, as indicated in Preamble Section VIII, while other spent chemical neutralization solutions meet LDR standards as generated, spent chemical neutralization solutions from the RRS and MMD, and from neutralization of lewisite, do not meet LDR standards as generated. In the case of spent neutralization fluids from the RRS and MMD, DSHW believes that the neutralization fluids are capable of achieving the LDR concentration-based standards. However, the spent neutralization fluids contain materials that interfere with chemical analysis. The Army's analytical methods are, at present, incapable of consistently measuring the concentration of the analytes of concern at levels at or below the LDR concentration-based standards. Hence, the Army has been unable to support chemical neutralization as an LDR technology for these waste streams. DSHW is instead proposing that a

LDR standard of incineration be applied to the MMD and RRS spent neutralization fluids.

In the case of lewisite, DSHW believes that considering the high arsenic content, chemical neutralization is the appropriate technology (as opposed to incineration). However, the Army is presently just beginning its program at CAMDS to evaluate the adequacy of the Canadian neutralization process referred to above. EPA has nevertheless developed numerical LDR standards for arsenic. The spent neutralization fluid consists mostly of sodium arsenate. DSHW believes that application of stabilization, as described in 40 CFR 268.44, will be able to achieve the LDR standard for arsenic. DSHW is therefore proposing that the LDR technology for treatment of lewisite-derived spent neutralization fluid be stabilization. Although an LDR technology is here proposed for lewisite-derived spent neutralization fluid, DSHW notes that analyses for arsenic will be required if the spent neutralization fluid exceeds the toxicity characteristic for arsenic in order to comply with EPA's LDR standards, which DSHW has adopted in R315-13.

Neutralized residues, including those described under proposed categories K901 (with exceptions noted), K902, and K903, may be land disposed in a permitted hazardous waste landfill. If and when these residues meet the proposed exemption levels, they are no longer subject to regulation as a hazardous waste under Utah hazardous waste management rules. Further treatment to meet LDR standards is required, however, if the residuals exhibit any of the RCRA characteristics, as adopted in R315-2-9. Note that liquid materials, or materials containing free liquids, are prohibited from land disposal unless the liquid is first solidified or is removed by other means (such as use of sorbents).

3. Emerging Technologies

As indicated above, emerging technologies may be used for any waste stream provided that the Army can demonstrate that the concentration-based LDR standard is met. For example, CAMDS is currently evaluating thermal technologies for treatment of demilitarization protective ensemble (DPE) suits (a specific waste stream included under K903). Thermal desorption involves heating of physically solid or semisolid materials in an enclosed chamber under either oxidizing or nonoxidizing atmospheres at sufficient temperature, pressure, and residence time to vaporize liquids and hazardous contaminants into a gaseous exhaust stream. That exhaust stream is then either introduced into an afterburner, a scrubber system, or a filter system. Although this waste type can be incinerated, the Army determined that because the DPE suits are made of chlorinated hydrocarbons, incineration may produce chlorinated dioxins and furans. The Army therefore prefers the thermal desorption technology, which does not result in formation of these compounds. Thermal desorption of DPE suits is not proposed as an LDR

technology per this rulemaking, but may become an approved LDR technology in the future.

In addition, the Army is currently evaluating a number of technologies under its Assembled Chemical Weapons Assessment (ACWA) program. The Army expects that one or more of these technologies may prove sufficiently effective to warrant consideration as an LDR technology. DSHW notes that most of these technologies, if not all of them, would need to be implemented at Army facilities as a permitted activity.

DSHW proposes to incorporate, as part of today's rule, a process by which proven technologies, such as thermal desorption and ACWA technologies, can be incorporated into the LDR program as technology-based standards with a minimum amount of documentation and through an expedited process. First, DSHW proposes to work with the Army on emerging and innovative technologies, such that appropriate documentation for incorporating the technology as an LDR technology can be produced alongside the technology demonstration. DSHW proposes that criteria for an acceptable technology be established, as part of today's proposed rule, that can be used to incorporate new technologies without going through the formal "proposed rule-comment period-final rule" process. In this manner, emerging and innovative technologies can be incorporated into the rules in a minimum amount of time and with minimal documentation.

Very simply, if the Army demonstrates, through documentation described above, that the technology is capable of routinely treating the waste in question to below the LDR concentration-based standards, in a safe and effective manner, the DSHW will incorporate the technology into the hazardous waste rules as an approved LDR technology. A notice identifying the new LDR technology will be published in the state record.

C. RELATIONSHIP TO EPA LAND DISPOSAL RESTRICTIONS REQUIREMENTS

As indicated above, EPA's LDR program, which is outlined in 40 CFR 268, has been adopted by DSHW under R315-13. DSHW proposes to employ the framework LDR program for all the wastes listed in today's proposed rule, with the following deviations:

1. The decision to base LDR concentration and technology standards on health-risk rather than BDAT,

2. The choice that DSHW proposes to provide to the Army to employ either LDR concentration-based standards or LDR technologies, and
3. The manner in which emerging technologies may be incorporated into the regulations.

In addition to the above, DSHW notes that the risk-based approach for determination of the LDR concentration-based standards is based on modeling and a scenario that considers exposure to TSDF workers (Preamble Section XI provides details on this approach). The choice of using a worker-based scenario as opposed to an environmental exposure scenario was predicated on the fact that chemical agents will not persist for long in the environment (see Background Document B and Appendix E of Background Document E). A worker-based exposure scenario was thought to be much more likely (although still improbable) to actually result in exposure. This approach of using a worker-based scenario may also be interpreted as a type of deviation from the EPA approach, since most of EPA's risk-based applications consider environmental exposure scenarios.

DSHW wishes to clearly point out that in cases where the listed waste in question also exhibits a RCRA characteristic, the 40 CFR 268 LDR program, as adopted by DSHW under R315-13, is applicable. Most significant are the provisions of the LDR program that apply to underlying constituents. In accordance with these provisions, if wastes exhibit the RCRA characteristics, the generator is required to examine the wastes for underlying constituents and comply with LDRs for these constituents.

D. HAZARDOUS DEBRIS

As indicated in Preamble Section VIII, another option for the Army for management of some of its waste streams is to define these materials as hazardous debris. The hazardous debris standards are provided in 40 CFR 268.45; these standards are adopted by DSHW under R315-13, along with other LDR provisions. The definition of debris is provided in 40 CFR 268.2(g). Debris is defined as solid material exceeding a 60-mm particle size that is intended for disposal and that is: "a manufactured object; plant or animal matter; or natural geologic material." Additional provisions of the debris definition address materials that are not debris.

According to EPA's definition of debris, a number of waste streams addressed under today's proposed rule can be considered hazardous debris, including scrap metal under K902, laboratory solids under K902 and K903, and

other materials under K902 and K903. EPA's hazardous debris standards in 40 CFR 268.45 can be applied to these materials, in full compliance with EPA and DSHW standards. The advantage of defining these materials as debris is that LDR standards for these materials are much reduced. In many cases, extraction or destruction technologies can be used to meet LDR standards, resulting in removal of the listed waste code (i.e., the debris are no longer hazardous).

Notwithstanding the requirements outlined in today's proposed rule, the Army may apply the hazardous debris standards to any listed waste that meets the definition of debris. Since DSHW has incorporated the debris standards into its regulations, however, DSHW has determined that no proposed rule language is needed to permit application of the debris standards.

E. WAIVER OF STORAGE PROHIBITION

In the final Military Munitions Rule, EPA codified its interpretation that RCRA Section 3004(j) does not apply to waste chemical agents and munitions (62 FR 6622, February 12, 1997). Much of the discussion below is excerpted from the final rule.

RCRA Section 3004(j) prohibits the storage of hazardous waste for which one or more methods of land disposal are established, unless such storage is for the sole purpose of accumulating quantities needed for proper recovery, treatment, or disposal. The storage prohibition could, on its face, be interpreted to apply to waste chemical agents and munitions proposed to be listed under today's rule. Congress enacted Section 3004(j) in 1984 because it believed that permitting storage of large quantities of waste as a means of forestalling required treatment would involve health threats equally serious to those posed by land disposal.

In the case of chemical agents and munitions, however, Congress has, subsequent to enactment of Section 3004(j), statutorily limited the ability to move waste chemical agents and munitions from storage to treatment and disposal; EPA believes that this demonstrates Congress' intention that the storage prohibition should not apply to waste chemical agents and munitions. Specifically, in 1985, one year after enacting RCRA Section 3004(j), Congress established a comprehensive scheme for the management and ultimate destruction of waste chemical agents and munitions (see 50 U.S.C. Section 1521). That scheme, which Congress has updated and amended in intervening years, requires detailed study of destruction options for the chemical agents and munitions and provides for destruction of the chemical agents and munitions to be completed by a specific date [see, e.g., 50 U.S.C. Section 1521 (a), (b), and (d)]. As originally enacted, Congress required destruction of the chemical agents and munitions by

September 30, 1994, but Congress has recently extended that deadline to 2007 [50 U.S.C. Section 1521(b)(5)].

In light of the detailed congressional plan for destruction of the chemical agents and munitions, and their necessary storage pending destruction, EPA believed that Congress did not intend the prohibition on storage in RCRA Section 3004(j) to apply to chemical agents and munitions. This position was articulated in the final Munitions Rule. Accordingly, this proposed rule provides that waste codes K901 through K908, P901 through P910, and U901 through U902 are not subject to the prohibition on storage or any other requirements of 40 CFR 268.50, as adopted in R315-13. Although DSHW has not yet adopted the EPA munitions rule into its regulatory program, the waiver of the prohibition on storage for the chemical agents and the associated wastes is applicable in the State of Utah.

F. CAPACITY

When EPA develops LDRs for specific wastes, a "capacity determination" is conducted to identify if there is sufficient availability or capacity, either on-site or off-site (e.g., commercial) for treatment and disposal of the waste to meet the LDR standard. If EPA determines that there will be either a short- or long-term capacity shortfall, EPA can issue a capacity variance for the waste and extend the effective date by which treatment before land disposal would be required. Generators can also petition EPA for a site-specific capacity variance in cases where capacity is expected to be limited on a local or regional basis.

The capacity variance was a necessary element of the RCRA LDR program considering the storage prohibition discussed above. The fact that treatment or disposal capacity for a waste does not exist or is inadequate is not enough, by itself, to overcome the storage prohibition. Wastes for which there was no or limited treatment capacity could not be land disposed without meeting the LDR standards, and at the same time, could not be stored pending the availability of treatment. Without any other options, Congress provided for the capacity variance.

Because DSHW has determined that the storage prohibition does not apply to chemical agents and associated wastes, and considering that national capacity is not an issue in this state rule, DSHW has determined that it does not need to conduct a formal capacity analysis. However, DSHW believes that there is sufficient capacity on-site at Army installations for treatment of the chemical agents that are defined as waste (i.e., the "P" and "U" wastes), and that there is

sufficient capacity, either on-site or off-site (commercial) for the treatment and subsequent disposal of the process "K" wastes.

Despite the availability of capacity, because of the inapplicability of the storage prohibition, the Army may choose to store indefinitely any chemical agent associated waste stream that it determines appropriate. DSHW is in favor of the Army retaining this flexibility. For example, DSHW believes that it is appropriate for the Army to store DPE suits pending development of the thermal desorption treatment option discussed earlier in this section of the Preamble.

G. WASTEWATERS VS. NONWASTEWATERS

As indicated in Section VIII.B.4 of this Preamble, DSHW is proposing as part of today's rule that wastewaters and nonwastewaters be defined as specified in 40 CFR 268.2, with an additional modification. Under the EPA LDR program (adopted by DSHW under R315-13), a different LDR concentration-based standard is applied depending on whether the waste is defined as a wastewater or nonwastewater. Wastewaters are defined in 40 CFR 268.2 as wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS), with exceptions pertaining primarily to liquid materials that contain organic solvents. Nonwastewaters are defined simply as materials that are not wastewaters. These definitions are important considering that a different LDR concentration-based standard is applied in today's proposed rule, depending on how the waste is classified.

DSHW notes, however, that although some "liquid" waste may in some cases exceed the EPA TOC and TSS criteria for wastewaters and thus may be defined as nonwastewaters, they are nevertheless liquid in nature. As explained in Preamble Section XI, the LDR standards for liquids and solids are derived using different exposure assumptions. For this reason, DSHW believes that the LDR concentration-based standard for liquid wastes should be applied for all wastes that are liquid in nature, including those that would otherwise be defined as nonwastewaters. The DSHW is proposing, therefore, that the nonwastewater category be further broken down into nonwastewater liquids and nonwastewater solids. The LDR standard for wastewaters will be applied to both the wastewater category and the nonwastewater liquids category. The LDR standard for nonwastewaters will be applied to the nonwastewater solids category only.

DSHW further proposes to apply EPA's paint filter liquids test (Method 9095A) as established in EPA's SW-846 Testing Manual (EPA 1996d) to differentiate nonwastewater liquids from nonwastewater solids. The paint filter test is normally used to identify wastes that require measures to remove the free

liquids (e.g., adsorption, stabilization) before land disposal. If application of the test results in liquid being released from a waste, the waste is defined as a nonwastewater liquid and LDR standards for wastewaters will apply. If no free liquid is released from a waste as a result of the test, the waste is defined as a nonwastewater solid, and the LDR concentration standard for nonwastewaters will apply. The LDR technologies may, nevertheless, be employed for any waste defined as a wastewater or a nonwastewater. DSHW also wishes to clarify that generators may apply process knowledge in lieu of performing Method 9095A.

Finally, DSHW notes that generators may remove liquids from nonwastewater liquids, by various means, such that they are classified as nonwastewater solids. Brine liquids and sludges, for example, are often dewatered (e.g., at TOCDF) to produce brine salts.

X. EXEMPTIONS FOR LISTED WASTE

This section discusses land disposal restriction (LDR) exemptions for the listed wastes. Development of the exemption concentration standards (concentrations for individual constituents) is discussed in Section XI of today's preamble. This section of the preamble discusses other elements of the exemptions.

A. GENERAL APPROACH

As discussed in Section V.H of this Preamble, on December 21, 1995, the U.S. Environmental Protection Agency (EPA) proposed the Hazardous Waste Identification Rule (HWIR) for process waste (60 FR 66344). This proposed rule would allow listed hazardous wastes to exit the Resource Conservation and Recovery Act (RCRA) Subtitle C regulatory framework if those wastes contain hazardous constituents at concentrations below the "exit levels" established for 367 hazardous constituents. Once the waste is exempted, it is not hazardous waste, but solid waste, and can be managed in compliance with state-implemented RCRA Subtitle D provisions. The exit levels would apply to all listed wastes (including waste mixed with or derived from listed wastes), regardless of origin. The exemption process is designed to be self-implementing once notification and certification have been made and a public notice issued. Because EPA does not list agent associated wastes as hazardous, the HWIR would not apply to these wastes.

The proposed HWIR waste rule was very complex and also controversial. EPA received numerous comments from the regulated community, including the State of Utah. While most commenters agreed with the concept of an exit level, many commenters were critical of the manner in which proposed exit levels were determined. The risk assessment models have drawn criticism from environmental interest groups, industry groups, and EPA's own Science Advisory Board (SAB). EPA has indicated that it expects to repropose the HWIR-Waste rule by October 31, 1999, and finalize it by April 30, 2001. Hence, the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) expects that the HWIR rule, when finalized, may include significantly different language than that presented in the proposed version. However, the general rationale and approach of the HWIR rule (i.e., exemption of nonhazardous waste streams as determined by a health risk evaluation) is incorporated into the philosophy and approach for today's proposed UCAR.

The exemption levels proposed for the chemical agents and associated wastes are discussed in Section XI of today's proposed rule. These levels are

based on a conservative multipathway risk assessment process developed by EPA Region IX. DSHW is proposing that exemption levels apply only for nonwastewater solids. Wastes defined as wastewaters or nonwastewater liquids would not qualify for exemption. Generators may remove liquids from nonwastewater liquids, by various means, such that they are classified as nonwastewater solids. Brine liquids and sludges, for example, are often dewatered (e.g., at TOCDF) to produce brine salts.

DSHW also wishes to note that "U" wastes [DM (U901) and BZ (U902)] are not eligible for exemption. Exemption levels are not presently available for these wastes.

B. RELATIONSHIP TO OTHER HAZARDOUS WASTE RULES

1. Land Disposal Restrictions

Today's proposed "P", "U", and "K" listings; the LDRs; and the exemption levels are all part of an integrally related program. DSHW fully expects that many of the "P", "U", and "K" chemical agent associated wastes that are treated to meet LDRs will qualify for the exemption levels proposed today. In addition, DSHW anticipates that some wastes will qualify for the exemption without LDR treatment. To qualify for the exemption, however, wastes must be analyzed to ensure that concentrations of individual constituents are below the exemption levels proposed today. The relationship between proposed "P", "U", and "K" listings; the LDRs; and the exemption levels is depicted in Figure VI-1 of this Preamble.

Wastes proposed to be listed today must also satisfy additional LDRs if they are otherwise defined as hazardous under the RCRA program. Of concern here is whether agent associated wastes are mixed with or contain other RCRA-listed hazardous wastes and/or exhibit any of the RCRA characteristics. Furthermore, if wastes exhibit RCRA characteristics, universal treatment standards must be met for underlying constituents, as provided in 40 CFR 268.9 (adopted by DSHW in R315-13).

2. Other Hazardous Constituents

Some of the "P", "U", and "K" wastes that qualify for exemption as identified in today's proposed rule may contain other hazardous constituents (i.e., those in 40 CFR 261 Appendix VIII, as adopted by DSHW in R315-50-10) or exhibit RCRA characteristics. Generators may still pursue and obtain an exclusion from being listed as an agent associated "P", "U", or "K" waste, even if the waste

is mixed with or contains another RCRA listed hazardous waste, and/or exhibits a RCRA characteristic. Although the waste will remain hazardous under the state's regulations, there are advantages associated with the lifting of the listed-agent waste status. Most notably, off-site management (of "K" wastes) will only need to consider nonagent requirements.

The Table X-1 matrix illustrates the disposition of listed and characteristic wastes under today's proposed rule.

C. TESTING REQUIREMENTS

1. Analytical Requirements and Limitations

Methods used to analyze for the constituents against the exemption levels must be sufficiently sensitive to detect constituent concentrations at the exemption levels proposed in today's rule. DSHW is not proposing to "cap" exemptions levels at analytical method quantitation or detection limits (as EPA proposed to do in the HWIR). DSHW is proposing, very simply, that if analytical methods are not sufficiently sensitive to detect waste concentrations at the proposed exemption levels, the wastes will not qualify for the exemption. Analytical methods are discussed further in Section XII of this Preamble.

2. Initial Test

For each waste for which an exemption is to be sought, DSHW is proposing to require the generator to test for hazardous constituents, as indicated below, except those constituents that are unlikely to be present in the waste. DSHW is further proposing that the generator be required to document the basis of this determination. Constituents that must be evaluated as part of this determination are:

- Constituents listed in Appendix VII of 40 CFR Part 261 (as adopted by DSHW under R315-50-9) as the basis for listing the waste for which the exemption is sought, that are determined to be reasonably present in the waste; and
- Appendix VIII constituents added in R315-50-10(1), for which the claimant knows or has reason to believe are persistent by-products to the process that generates the waste.

In addition to the above, DSHW is requiring that generators pursuing the exemption develop a sampling and analysis plan for each waste for which an

TABLE X-1 Disposition of Listed and Characteristic Wastes

Agent Associated "P" or "K" Waste Is Eligible for: ^a			
Agent Associated "P" or "K" Listed Waste Plus:	Exemption from All Hazardous Waste Requirements	Exemption from Agent Listing Only (waste still regulated as hazardous waste)	Comments
Mixed with or contains other RCRA-listed waste ("P", "U", "F" or "K")	No	Yes	Waste may be eligible for exemption after EPA finalizes HWIR and DSHW adopts the rule.
Exhibits one or more RCRA characteristics	Possibly	Yes	If waste no longer exhibits a characteristic (e.g., due to treatment), is eligible for complete exemption.
Mixed with or contains other RCRA listed waste ("P", "U", "F" or "K") and exhibits one or more RCRA characteristics	No	Yes	Waste may be eligible for complete exemption after EPA finalizes HWIR and DSHW adopts the rule, and if waste no longer exhibits a characteristic (e.g., due to treatment).
Not mixed with and does not contain other RCRA listed waste ("P", "U", "F" or "K") and does not exhibit a RCRA-characteristic	Yes	No	Because waste would not be hazardous under the federal RCRA program, would only be considered a state-regulated listed waste and would be exempt from all requirements.

^a Wastes defined as U901 or U902 are not presently eligible for exemption. Wastes defined as wastewaters or nonwastewater liquids are also not presently eligible for exemption.

exemption is sought. The plan must identify sampling procedures and locations sufficient to characterize the waste and the analytical methods that will be used.

3. Retesting

DSHW is further proposing that facilities retest the waste for which the exemption was claimed on an annual basis. No testing would be required if no waste is generated during any one year period of the exemption. In addition, as with the initial exemption, for every retest the facility would be required to prepare and comply with a sampling and analysis plan meeting the same requirements discussed above for the initial testing.

D. OTHER REQUIREMENTS

1. Notices

DSHW is proposing to require the generator to issue two notices before the exemption becomes effective. These include a notice to the Utah Hazardous Waste Control Board and a public notice. These notices are summarized below:

- *Notification to State of Utah Solid and Hazardous Waste Control Board (The Board):* DSHW is proposing to require the generator to send a notice to the Board of the exemption claim. This notice is proposed to include the name, address, and RCRA ID number of the facility claiming the exemption; the applicable hazardous waste codes as established in the Utah Administrative Code; a brief description of the process that generated the waste; an estimate of the average and maximum monthly and annual quantities of each waste claimed to be exempt; documentation for any claim that constituents are not present in the waste above exemption levels; the waste analysis plan prepared as described above; the results of analyses; an indication as to when and in what newspaper a public notice will appear; and the following statement signed by an authorized representative of the facility claiming the exemption:

Under penalty of criminal and civil prosecution for making or submitting false statements, representations, or omissions, I certify that the requirements of R315-2-26(b) have been met for all waste identified in this notification. Copies of the records and information required at R315-2-26(d)(6) are available at

[name of the facility]. Based upon my inquiry of the individuals immediately responsible for obtaining the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

- **Public Notice:** DSHW is proposing that generators submit for publication in a major newspaper of general circulation, local to the facility, a notice entitled "Notification of Exemption Claim for Listed Hazardous Waste under the Utah Hazardous Waste Management Rules." This notice must contain the name, address and RCRA ID number of the facility; the applicable hazardous waste code of the waste for which the exemption is claimed and the narrative description associated with the listing from R315-2-10(g) or R315-2-11(e)(1) or R315-2-1(f)(1); a brief, general description of the manufacturing, treatment, or other process or operation producing the waste; an estimate of the average and maximum monthly and annual quantities of the waste claimed to be exempt; and the name and mailing address of the State of Utah Solid and Hazardous Waste Control Board, where comments may be sent.

The public notice must be published within 2 weeks of submission of the notice to the Board.

2. Effectiveness of Exemption

DSHW is proposing that the exemption will become effective after the facility receives written notification from the Executive Secretary of the State of Utah Solid and Hazardous Waste Control Board approving the exemption. DSHW proposes to not attach any conditions, other than those identified in today's proposed rule (discussed below), as part of this exemption.

3. Conditions for Maintaining the Exemption

DSHW proposes that to maintain an exemption, the facility must satisfy a number of conditions. First, the facility must submit to the Board any change in information submitted under the notices described above within 10 business days of the facility's first knowledge of the change. Second, the schedule for retesting must also be complied with. Third, the concentrations of all constituents tested must continue to meet the exemption levels.

If any exempted waste loses its exemption (e.g., because a constituent is detected above an exit level), an application may be filed with the Board for reinstatement of the exemption from hazardous waste regulation with respect to such waste as soon as the waste is returned to compliance with the exemption levels. If the Board finds that reinstatement of the exemption is appropriate on the basis of such factors as the claimant's provision of a satisfactory explanation of the circumstances of the loss of exemption, or a demonstration that the loss of exemption is not likely to recur, the Board may reinstate the exemption. DSHW is further proposing that if the Board does not take action on the reinstatement application within 60 days after receipt of the application, then reinstatement shall be deemed granted, retroactive to the date of the application. However, the Board may terminate a exemption reinstated by default in the preceding sentence if the Board finds that reinstatement is inappropriate based on factors such as the claimant's failure to provide a satisfactory explanation of the circumstances of the loss of exemption, or failure to demonstrate that the loss of exemption is not likely to recur. In reinstating the exemption, the Board may specify additional conditions as are necessary to ensure and document compliance.

4. Record Keeping

DSHW is proposing that the facility maintain records of the following information in on-site files for 3 years after the date of the relevant test:

- For initial testing, all information submitted under R315-2-26(b)(4), all revisions to such material submitted under R315-2-26(d)(1), and all information required to be maintained under R315-2-26(d)(6)(iii); and
- For retests, sampling and analysis plans required under R315-2-26(d)(3) and analytical results for constituents required to be assessed under R315-2-26(d)(3).

Furthermore, DSHW is proposing that both for initial tests and retests, the facility retain records of the dates and times when waste samples were obtained; the dates of the analyses; the names and qualifications of the person(s) who obtained the samples; a description of the temporal and spatial locations of the samples; the name and address of the laboratory facility at which the samples were analyzed; identification of the analytical methods used, including any cleanup and extraction methods; detection limits achieved and other quality control results (including any method blanks, duplicate analyses, and matrix spikes); laboratory quality assurance data; a description of any deviations from published analytical methods or from the plan; and other laboratory documentation that supports the analytical results.

5. Other

To clarify the effect of the exemption, DSHW is also proposing that the exemption include LDR requirements, as adopted in R315-13. If all hazardous constituent levels in a waste qualifying for exemption are at or below the exemption levels at the waste's point of generation, and if the waste is not otherwise defined as hazardous under the state's rules, the waste is exempt from all requirements of 40 CFR Part 268, as adopted in R315-13.

E. CLARIFICATIONS REGARDING CONTAMINATED MEDIA

Contaminated media are not treated differently from process waste under today's proposed rule. The exemptions apply to media that are defined as hazardous waste in the same capacity as "as generated" wastes.

XI. DEVELOPMENT OF HEALTH-BASED WASTE MANAGEMENT CONCENTRATION LEVELS

A. GENERAL

This section describes how different concentrations of agent residue in waste material may be used to determine how that waste is managed, treated, and disposed of. Specifically, the basis, methodology, and assumptions used to derive health-based Land Disposal Restriction (LDR) concentration standards and exemption levels are described.

B. RATIONALE FOR HEALTH-BASED CONCENTRATION LEVELS FOR MANAGEMENT OF CHEMICAL AGENT WASTES

The Army considers the current practices described in Section III of this Preamble as being adequate to ensure protection of public health, to include Army personnel and the general public. However, the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has indicated concerns that because of the military-unique nature of chemical agents, the toxicity and handling requirements of the associated waste are best understood by Army personnel who have the necessary historical knowledge, training, and protective equipment to safely manage agent contaminated items and materials. While this may be true for pure or neat quantities of chemical agent, *residual* chemical agent bound or mixed in a waste matrix poses a health risk similar to or even less than other forms of toxic industrial wastes or chemical products. Specifically, this section defines the concentrations of the agents and other newly added hazardous constituents at or below which there is a minimal or acceptable level of risk to potentially exposed populations.

Generally, determining chemical concentrations that ensure a minimal or acceptable level of risk requires the:

- Identification of the population at greatest risk to exposure and information regarding the scenario/conditions by which such exposure may occur,
- Selection of a method/model describing the process of potential exposure, and
- Determination of what is considered an acceptable level of risk.

Two types of concentration levels are described in this rule: (1) the LDR concentration-based standards, and (2) exemption levels. LDR concentration-based standards represent a set of concentrations below which wastes may be safely disposed of as a hazardous waste at a treatment, storage, and disposal facility (TSDF). Exemption levels establish a set of concentrations below which wastes may be managed as nonhazardous under Resource Conservation and Recovery Act (RCRA) Subtitle D provisions. Altogether, the LDR concentration-based standards and exemption levels provide the foundation for a new chemical agent waste classification and management system for the State of Utah. These concentration levels, however, only pertain to the chemical agents and the newly added hazardous constituents identified in this rulemaking; wastes may still require treatment or management as a hazardous waste for other constituents or characteristics.

1. Land Disposal Restriction Concentration-Based Standards

This proposed rule identifies new specific chemical agent waste codes (as discussed in Preamble Sections VII and VIII) and establishes LDR requirements for these wastes that include technology-based treatment options or health-based concentration levels for the newly listed wastes. These LDR health-based concentration standards define levels of chemical agent residue that may remain in a waste matrix such that the waste may be disposed of at a commercial RCRA Subtitle C permitted hazardous waste facility without resulting in any unacceptable health risk.

Waste items or materials that are potentially or known to be contaminated with or contain chemical agents are required to be managed, decontaminated, and/or monitored in accordance with specific Army safety regulations and policies as described in Section III of this Preamble. In accordance with these Army requirements, waste materials may be treated and disposed of as hazardous wastes at permitted RCRA Subtitle C TSDFs if air monitoring ensures that agent concentrations are below levels of health concern. Hazardous wastes are managed by specifically trained personnel with specialized equipment that includes protective clothing and respirator devices. Treatment and disposal operations at TSDFs are performed in a strictly regulated environment that is scrutinized by means of audits, inspections, and submittal of various documents. These TSDFs are designed to meet requirements that ensure hazardous wastes are controlled and treated so as to minimize the possibility of release or threat to the general population. One such requirement includes the treatment of wastes to RCRA LDR standards before the waste can be placed in a hazardous waste landfill. The RCRA LDR standards ensure that the potential for future leaks from hazardous waste landfill containment systems will not pose environmental health hazards. Under such requirements, wastes must either be treated by specified technology systems

or be treated to reduce the concentration of specified constituents to specified levels. As discussed in Section V of this Preamble, the LDR concentration standards for industrial compounds themselves are generally based on the achievable limits demonstrated through various technologies.

Although the primary intent of the federal LDR requirements was to protect against potential future leaching and migration of contaminants to groundwater, it has been determined that potential release of chemical agent residues from disposed waste materials followed by migration to groundwater was not a probable scenario. The basis for this conclusion includes (1) the unique chemical and physical properties of the chemical agents, (2) the types and quantities of wastes that are generated, and (3) the geological setting and construction requirements of hazardous waste landfills. This assertion is more thoroughly discussed in Appendix E of Background Document E.

Despite the conclusion that groundwater was not at risk of contamination, the DSHW determined that the LDR initiative should be pursued to establish a scientific basis for waste management requirements and to further validate the adequacy of existing procedures.

In light of the categories of waste defined by LDR requirements (i.e., nonwastewater as well as wastewaters), two sets of LDR concentration-based standards have been derived. One set is based on exposures to a solid waste matrix, the other set is based on a liquid-based matrix. In addition, since certain nonwastewater matrices may actually be liquid in nature, the category of nonwastewaters is further broken down as either solid or liquid wastes. The LDR concentration-based standards derived herein are therefore represented as either LDR_{sol} (for assessing solid nonwastewater matrices) or LDR_{liq} (for assessing wastewaters or liquid nonwastewaters).

2. Exemption Levels

Additional health-based concentration levels have recently been developed and are discussed in Background Document E (*Derivation of Health-Based Environmental Screening Levels for Chemical Warfare Agents*). That report describes scenarios under which there is a potential for exposure of different types of populations from contaminants in soil. The document describes the current U.S. Environmental Protection Agency (EPA) methodologies and assumptions commonly used to assess the need for potential remediation/cleanup activities at contaminated sites. This rule proposes that a similar rationale may be used to develop criteria to determine whether certain waste materials containing extremely low levels of chemical agents or related compounds no longer retain the toxic properties warranting the classification as a hazardous waste. Specifically, residual

agent concentrations that would be considered sufficiently low as to pose no unacceptable health risk in contaminated soil at an industrial site would similarly not be considered hazardous in wastes that were to be disposed of at a RCRA Subtitle D landfill. This concept of exempting low-risk wastes from RCRA Subtitle C requirements is similar to that previously proposed and still under development by the EPA Hazardous Waste Identification Rule (HWIR) rule-making initiative described in Section V.

C. POPULATIONS OF CONCERN

The LDR and the exemption levels described in this proposed rule are designed to ensure protection of the population (persons) with greatest potential of being exposed. Specifically, the LDR concentration-based standards address those persons potentially exposed when waste is to be disposed of in a RCRA Subtitle C facility. Exemption levels focus on the most likely exposed populations under the conditions and requirements established by state-implemented Subtitle D landfill requirements. The conditions under which persons may theoretically be exposed to chemical agent residues in waste materials or items will depend on the mechanism of waste management and disposal. As described above, this rule proposes two general chemical agent related waste management options for items/materials that the Army designates for disposal:

- The waste may be considered a hazardous waste and treated and disposed of at a permitted RCRA TSDF in accordance with LDR requirements, or
- The waste may be determined as nonhazardous and exempted from hazardous waste regulatory requirements.

The selected populations of concern for each waste management option are discussed below.

1. Management as Hazardous Waste — LDR Concentration-Based Standards

Wastes that are identified and managed as hazardous wastes undergo strict management controls that minimize human exposures. Because of these strict controls, there are no defined members of the general population who would be exposed to a chemical agent waste identified as a hazardous waste. Certain members of the civilian workforce, specifically those at the TSDFs, however, may theoretically be exposed to the hazardous waste chemical agent residues. As described in Preamble Section III, the Army air monitoring (3X) requirements ensure

that the workers are adequately protected from potentially volatilized agent. In addition, significant occupational safety requirements established by the Occupational Safety and Health Administration (OSHA) mandate protective equipment, clothing, and engineering controls to prevent exposures to such personnel. However, the DSHW notes that the Army's 3X air standards do not address the potential for incidental ingestion or dermal exposure. Furthermore, the DSHW has identified potential insufficiencies in occupational protective measures resulting in potential repeated exposures to the worker population. Therefore, workers at a hazardous waste landfill have been selected as the population of concern for deriving the LDR concentration-based standards.

2. Exemption from Hazardous Waste Requirements — Exemption Levels

Wastes not identified as hazardous waste are subject to state-implemented Subtitle D requirements. The potential for exposure to such wastes involves a somewhat less protected population of individuals than that managed under Subtitle C requirements. Because there are still specific Subtitle D management and manifesting requirements, the general civilian population is not likely to be exposed. Under such conditions, members of the landfill workforce will have the greatest opportunity for exposure to the residual agent from the contaminated matrix. Personnel working at a landfill subject to Subtitle D provisions are not required to maintain the same level of personnel protective equipment and clothing as is required for workers at a Subtitle C facility. As a result, their potential for exposure is greater and, therefore, the concentrations of agent in waste received by such facilities should be reduced to an acceptable level of risk.

D. METHOD AND ASSUMPTIONS

Existing Army policies and procedures regarding chemical agent waste address primarily the risks associated with inhalation. Inhalation is the most likely pathway of intermittent exposure to waste materials, and evaluation of this pathway is the most efficient and effective approach to identifying potentially acutely toxic waste. The potential for repeated exposures through all relevant pathways (e.g., incidental ingestion and/or dermal contact) is addressed by this rule. The method by which the proposed health-based levels (e.g., LDR concentration standards and the exemption levels) have been developed involves the use of standardized models derived by the EPA for use in environmental investigations. The EPA risk assessment guidance was originally established to determine cleanup goals/screening levels for Superfund sites. The same concept can be used in the development of health-based waste management levels.

The EPA risk assessment screening methodology involves the use of mathematical algorithms to back-calculate an environmental standard from a chronic toxicity constant. The chronic toxicity constant is a chemical-unique indicator of an acceptable daily dose (for a lifetime) of a compound. The EPA methodology assumes that the chemical comes from an environmental source (such as the soil or water) and that not all the chemical residue will actually enter the exposed person's body. Thus, the back-calculation is a mathematical model that begins with the chronic toxicity constant and then takes into account the process of the chemical residue moving from its source through the environment to an exposed person.

Although the EPA risk assessment screening methodology is generally standardized, several EPA Regional Offices have established specific guidance that contains certain variations. The risk assessment guidance from several EPA Regions (Regions III, IX, and IV) as well as the EPA Superfund guidance and EPA Office of Solid Waste and Emergency Response (OSWER) Soil Screening Guidance were considered for purposes of this rule-making (EPA 1989a, 1991a, 1995a-b, 1996a-c, 1997a, 1998). Specifically, the mathematical models used to establish predetermined chemical screening levels were evaluated.

1. The Mathematical Models

The models described below are specific to the type of matrix represented by a waste. Two basic matrices were assumed — solid (with soil the assumed matrix) and liquid (with water the assumed matrix).

a. Solid Matrices

The DSHW selected the EPA Region IX Preliminary Remediation Goals (PRGs) methodology (EPA 1998) as the primary model for use in this rule-making. This model is particularly comprehensive in that it estimates an acceptable concentration by an additive, multiple pathway (incidental ingestion, inhalation, and dermal absorption) algorithm describing exposure to a solid (soil) matrix. The EPA Region IX soil equations used to determine appropriate LDR concentration-based standards for solid (LDR_{sol}) carcinogenic (Equation XI-1) and noncarcinogenic (Equation XI-2) compounds are as follows:

$$LDR_{sol} = \frac{TR \times ATc \times BW}{EF \times ED \times \left(\frac{(FC \times IRS \times SF_0)}{CF} + \frac{(SA \times AF \times ABS \times SF_0)}{CF} + \frac{(INH \times SF_i)}{VF(orPEF)} \right)} \quad (XI-1)$$

$$LDR_{sol} = \frac{THI \times BW \times ATn}{EF \times ED \times \left(\frac{1}{RfD_o} \times \frac{FC \times IRS}{CF} \right) + \left(\frac{1}{RfD_o} \times \frac{SA \times AF \times ABS}{CF} \right) + \left(\frac{1}{RfD_i} \times \frac{INH}{VF(orPEF)} \right)} \quad (XI-2)$$

where

TR = target risk (unitless),

THI = target hazard index (unitless),

SF_o = slope factor (oral); chronic toxicity value (mg/kg/day)⁻¹,

SF_i = slope factor (inhalation); chronic toxicity value (mg/kg/day)⁻¹,

RfD_o = reference dose (oral); chronic toxicity value (mg/kg/day),

RfD_i = reference dose (inhalation); chronic toxicity value (mg/kg/day),

BW = body weight (kg),

EF = exposure frequency (days/year),

ED = exposure duration (years),

ATc = averaging time (carcinogenic effects) (70 years × 365 days/year),

ATn = averaging time (noncarcinogenic effects) (ED × 365 days/year),

CF = conversion factor (10⁶ mg/kg),

IRS = soil ingestion rate (mg/day),

FC = fraction of contaminated soil ingested (%),

AF = soil-to-skin adherence factor (mg/cm²),

SA = skin surface area exposed (cm²),

ABS = skin absorption factor (%),

INH = inhalation rate (m³/day),

VF = volatilization factor (m^3/kg), and

PEF = particulate emission factor (m^3/kg).

Each of these parameters is discussed in more detail below.

b. Liquid Matrices

For exposure scenarios involving agent related wastewater or liquid nonwastewaters, two exposure pathways were initially considered to be of potential concern: dermal contact with chemicals in an aqueous solution and inhalation of chemicals volatilized from such a solution. The ingestion pathway was not considered a viable process of exposure. Further evaluation concluded, however, that although the exposure pathways of concern include dermal and inhalation, the inhalation pathway is not considered relevant for the nerve agents (G-agents and VX) on the basis of the EPA guidelines for addressing the inhalation of compounds volatilized from aqueous media. Specifically, the EPA guidelines state that volatilization from water may be significant for chemical contaminants having a Henry's Law constant greater than $10^{-5} \text{ atm} \times \text{m}^3/\text{mol}$ and a molecular weight of less than 200 (EPA 1991a).

Although the G-agents have molecular weights of less than 200, they all have Henry's Law constants considerably less than $10^{-5} \text{ atm} \times \text{m}^3/\text{mol}$, as does VX (see Background Documents B and E). Therefore, these nerve agents are not expected to volatilize from aqueous media.

HD has a molecular weight of 159.08 and an estimated Henry's Law constant of $2.4 \times 10^{-5} \text{ atm m}^3/\text{mol}$, indicating that volatilization from water may occur; however, HD undergoes rapid hydrolysis in aqueous solutions. Dilute concentrations of HD ($\leq 10^{-5} \text{ M}$ or $\leq 1.6 \text{ mg/L}$) hydrolyze almost completely to thiodiglycol and hydrochloric acid. Hydrolysis half-lives of 14.7 minutes at 20°C and 4 minutes at 25°C have been reported. With such rapid hydrolysis, volatilization of the agent is unlikely to occur. (See Background Documents B and E for additional information.)

Lewisite has a molecular weight of 207.32 and a Henry's Law constant of $3.2 \times 10^{-4} \text{ atm m}^3/\text{mol}$; therefore, according to the EPA guidelines, this compound would be expected to volatilize from aqueous solutions. However, lewisite undergoes rapid hydrolysis. The rate of hydrolysis is limited by the low solubility of the parent compound. Lewisite oxide can slowly hydrolyze to 2-chlorovinylarsonous acid (often called CVAA) in aqueous media. While CVAA is only minimally soluble in water, it may be present in the typically caustic

decontamination solutions. However, in such cases the CVAA will only be present in the ionized form and, therefore, not subject to ready volatilization.

Therefore, it is concluded that volatilization from wastewater or liquid nonwastewaters is unlikely to be a significant exposure pathway for the chemical agent related liquid wastes. The equations for modeling the exposure scenario involving a liquid matrix, assuming dermal absorption as the primary exposure pathway, are presented below. This model is adapted from the EPA Superfund guidance (EPA 1989a, 1991a).

LDR concentration-based standards for liquid-based wastes are computed with Equation XI-3 for contaminants with a carcinogenic effect²⁵ and Equation XI-4 for contaminants with a noncarcinogenic effect:

$$LDR_{liq} = \frac{TR \times BW \times ATc}{ET \times EF \times ED \times (CSF_0 \times SA \times PC \times 1 L/1,000 \text{ cm}^3)} \quad (XI-3)$$

$$LDR_{liq} = \frac{THQ \times BW \times ATn}{ET \times EF \times ED \times \left(\frac{SA \times PC \times 1 L/1,000 \text{ cm}^3}{RfD_0} \right)} \quad (XI-4)$$

where

LDR_{liq} = LDR concentration-based standards for liquid-based wastes (mg chemical/L wastewater),

TR = target cancer risk,

THQ = toxicity hazard quotient,

BW = body weight (kg),

ATc = averaging time for carcinogenic effects (365 days/yr for 70 yr)

ATn = averaging time for noncarcinogenic effects ($ED \times 365$ days/yr)

ET = exposure time (hours/day),

²⁵ Equation XI-3 is used only for HD because this is the only agent that is considered to be carcinogenic.

EF = exposure frequency (days/year),

ED = exposure duration (yr),

CSF_o = oral slope factor $[(\text{mg/kg/day})^{-1}]$,

SA = skin surface area exposed (cm^2),

PC = permeability coefficient, chemical-specific (cm/h), and

RfD_o = reference dose (oral); chronic toxicity value (mg/kg/day).

2. Model Assumptions

The EPA screening levels are based on assumptions that describe how certain generalized situations could theoretically result in the exposure of certain persons to a given chemical. These assumptions are reflected by the parameters described in the above equations. All parameters are reflected as single numerical values with the units as indicated. Some values are specific to the chemical and are therefore constant for risk assessments to that chemical, while other parameters depend on the exposure scenario being evaluated. In the process of establishing screening levels, site-specific exposure conditions can only be theorized and are therefore generally selected to fit the most reasonable worst-case conditions.

As stated above, the various EPA regions describe different levels of minimal/acceptable risk concentrations for chemicals for different generalized scenarios. This rule-making identifies different chemical agent residue concentrations that ensure that risk is minimized to an acceptable level for different specified exposure conditions of waste management (for the LDR concentration-based standards as well as the exemption levels). Specific numerical assumptions selected for calculations in this proposed rule are described in sections below. A majority of the parameters described are used in the calculations both for LDR_{sol} and LDR_{liq} concentration-based standards; however, some parameters are specific to the model and assumptions regarding the individual matrices. Tables XI.4 and Table XI.5 in Section XI.E.3 below summarize all parameters and their selected values.

3. Deterministic versus Probabilistic Approaches

Historically, the risk assessment screening process has been performed with the selection of single-value input parameters for the risk models described above. This procedure is referred to as the descriptive, or deterministic, approach.

The default values described in the EPA national and regional guidance documents are single values considered to be conservative for a specified, yet generic, scenario. However, the EPA recently has officially accepted the use of probabilistic analysis with Monte Carlo simulations in risk assessment (EPA 1997b). The probabilistic approach requires the use of distributions in place of single parameter values. The selection or process of obtaining distribution data can be very resource intensive. In addition, as described in the EPA guidance, this approach is most appropriate when site-specific information is available to adequately describe the type and shape of data distributions. Although there are uncertainties and assumptions inherent to both the deterministic and probabilistic approaches, the probabilistic approach allows for the quantification of the uncertainties in a given risk assessment calculation. Assuming that accurate, site-specific information is available, the probabilistic approach also demonstrates the use of a variety of parameter values that may more adequately reflect the population and exposure scenario of concern. However, because of the difficulties in obtaining site-specific information, it is still necessary to assume that the distributions selected reflect the actual scenario in order to accept the description of quantified uncertainty. Since the EPA guidance suggests that deterministic analysis should always be performed first in a risk assessment and that a probabilistic analysis can be used for comparative purposes to demonstrate uncertainties quantitatively, this proposed rule provides both analyses but will base the proposed LDR values on the deterministic approach.

Since the LDRs are based on a limited and somewhat distinct population of concern used as the basis for the LDR concentration-based standards, an additional effort in this rule-making included a probabilistic analyses for this scenario. (This type of analysis was not performed for the exemption levels, for which there is a less distinct population and exposure scenario.) The probabilistic analyses incorporate exposure parameter distributions that are believed to best describe the scenario and TSDF worker population. These analyses also provide a mechanism for identifying the degree of uncertainty in the process. To the extent possible, the distributions selected are based on actual data. The primary sources for distribution data are the EPA *Exposure Factors Handbook* (EFH) (EPA 1989b, 1997c) and the American Industrial Health Council (AIHC) *Exposure Factors Sourcebook* (EFS) (AIHC 1994). Some distributions are taken directly from the source documents, but several are derived from the available data in conjunction with conservative scenario-specific assumptions about the specific TSDF worker scenario.

E. DERIVATION OF THE LDR CONCENTRATION-BASED STANDARDS

1. Scenario Description

As described above, the population of concern for establishing LDR concentration-based standards is the commercial TSDF workforce. It is assumed that personnel at such facilities, although generally protected (through engineering controls and personal protective equipment [PPE]) from agent residues in these wastes, may on occasion become exposed through various pathways, including incidental ingestion, inhalation of volatiles or particulates, and dermal contact. As described previously, the likelihood of actual exposure (i.e., a "completed" exposure pathway) will depend on the matrix of the waste. The DSHW has identified the potential for exposures to occur on occasions when a combination of events occurs simultaneously. These events include the presence of contamination, the (repeated) presence of individual personnel, and the lack of appropriate/functioning engineering controls and PPE. In addition to the presence of a worker (or group of workers) under the necessary exposure conditions, the assessment also assumes that the *same* worker (or group of workers) is exposed on several occasions throughout the year. Although all of these conditions describe a theoretically possible scenario, this situation is considered a worst-case scenario. Thus, the resulting LDR concentration levels will be conservatively protective of the workforce.

2. Methodology and Approach

As stated previously, both the deterministic and the probabilistic analytical approaches were used with the selected models. The resulting proposed LDR concentrations are presented as those concentrations derived from the deterministic approach; the probabilistic approach estimates are provided for comparison as well as to demonstrate quantified uncertainties. Because both approaches are designed to give conservative results, a range of concentrations can be expected (i.e., the two approaches will not be expected to yield exactly the same values). However, the range will be limited (the differences will not be substantial). These two approaches to using the risk model are explained in more detail below.

a. Deterministic — Single-Value Parameters

The single-value parameters used in deriving the LDR concentrations were selected from various sources, including existing EPA default values as well as other, scenario-specific selections. Section E.3 "Parameters," below, describes the values and rationale for their selection in more detail.

b. Probabilistic — Distribution Parameters and Monte Carlo Simulation

A probabilistic analysis was performed using the distributions described below. Certain parameters, such as the RfD/SF, were input as single values as per EPA guidance. It is acceptable to have both single value and distributions in the analysis. All parameters considered by EPA as potential candidates for distribution data were used as such. The values used for single-value parameters in the probabilistic analysis are the same ones used in the deterministic analysis.

To perform the probabilistic analysis, the Monte Carlo statistical simulation process was used with Latin Hypercube distribution sampling for 25,000 reiterations. The concentration level selected from the resulting probabilistic distribution of chemical agent concentrations was chosen at the 95% upper confidence interval (CI). The entire distribution of chemical concentrations reflects the levels that may pose a risk at a predetermined risk level. The fact that many concentrations are represented by the distribution is an artifact of the probabilistic/Monte Carlo process, which uses variable values represented by the parameter distributions (i.e., the uncertainty and variability of the assumptions is incorporated and then depicted in the distribution curve). The 95% upper CI is defined as the level at which one is 95% confident that the concentration is in fact protective at the defined risk level. The upper 95% CI can also be presented as the "lower 5%" interval when starting at the lowest concentration level in the overall distribution of concentration values, meaning that there is a 5% probability that the risk at that concentration will exceed the accepted risk level. The selection of the 95% CI provides a highly conservative result. Figure XI-1 presents a graphical depiction of the distribution and its interpretation.

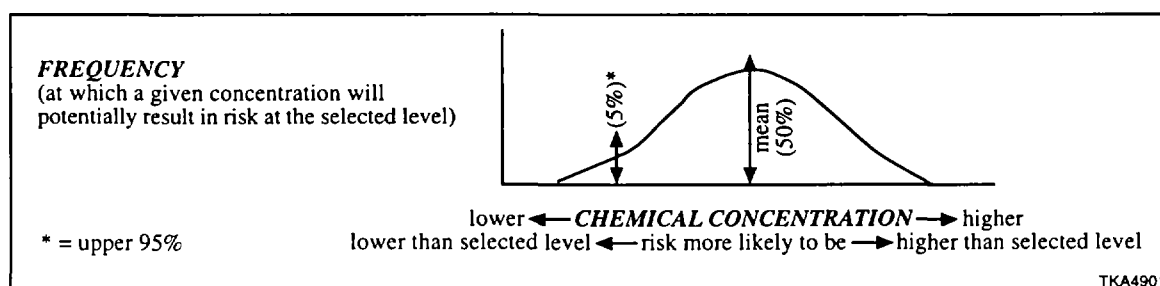


Figure XI-1 Graphic Depiction of Concentration Value Distribution

3. Parameters

The specific values and distributions of the individual parameters (for both deterministic and probabilistic analyses) used in Equations XI-1 through XI-4 are described below. Tables XI-1 through XI-5 summarize these values. Background Document G graphically portrays the distributions used to represent the parameters in the Monte Carlo simulation for the probabilistic analyses. Also included in Background Document G is a depiction of the sensitivity of the selected parameter distributions on the resulting distribution of concentrations. The sensitivity describes the relative impact of a given parameter to the resulting distribution of concentration levels.

a. Chronic Toxicity Constants

Table XI-1 summarizes the chronic toxicity constants used for the chemical agents in this proposed rule. The EPA currently suggests that, in general, chronic toxicity values be represented as single values, even when using a probabilistic approach. However, as constants, these values should not be construed as having more certainty associated with them than is the case for any other parameter used in the risk assessment equations. In fact, the uncertainty associated with these values is a part of their definition, which assumes they inherently reflect "uncertainty of an order of magnitude or more..." (EPA 1989a). The calculations upon which the toxicity values are based themselves require data extrapolations that must account for such variables as use of animal data, limited study subjects, unknown effects of human variability, and dose-time relationships, to name a few. Despite the significant uncertainties built into the chronic toxicity value and the significance of the impact that this value has on the overall outcome of the risk assessment, the uncertainties are assumed to be conservatively accounted for in the process of establishing the constant.

Two general types of toxicity constants exist: (1) reference doses (RfDs) and reference concentrations (RfCs) describe *noncancer* effects caused by a chemical; and (2) slope factors (SF) and unit risk (UR) describe the *carcinogenic potency* associated with compounds shown to cause cancer. Separate values are established for different modes of toxicity. For example, an RfD reflects the toxicity of the chemical when *ingested*, while the RfC reflects the toxicity of the chemical when *inhaled*. Reference values reflecting dermal toxicity are also sometimes available. EPA often uses the oral RfD as a substitute when data are lacking. For most industrial chemicals, the regulatory community has established approved toxicity constants. The most common source for these values is EPA's Integrated Risk Information System (IRIS) (EPA 1997d). For compounds not in IRIS, EPA allows use of other databases (e.g., the Health Effects Summary Tables

TABLE XI-1 Available Reference Doses, Slope Factors, and Inhalation Exposure Limits for Chemical Warfare Agents

Chemical	Oral RfD ^a (mg/kg/d)	Oral Slope Factor (mg/kg/day) ⁻¹	Inhalation Slope Factor (mg/kg/day) ⁻¹	General Public Air Exposure Limit ^b (mg/m ³)	Inhalation RfD ^c (mg/kg/day)
HD	7×10^{-6}	7.7^d	300^e	1×10^{-4}	3×10^{-5}
Lewisite ^f	1×10^{-4}	-	-	3×10^{-3}	8.6×10^{-4}
GA	4×10^{-5}	-	-	3×10^{-6}	9×10^{-7}
GB	2×10^{-5}	-	-	3×10^{-6}	9×10^{-7}
GD	4×10^{-6}	-	-	$1 \times 10^{-6}^g$	3×10^{-7}
Vx	6×10^{-7}	-	-	$3 \times 10^{-7}^h$	9×10^{-8}

^a Source: DA (1996).

^b Sources: CDC (1988); DA (1990, 1991).

^c Estimated from the air exposure limits using an inhalation rate of 20 m³/day and a body weight of 70 kg.

^d Geometric mean of estimated slope factors; see Section 1.2.4 of Background Document E.

^e Source: DA (1996); derived from an inhalation unit risk of 8.5×10^{-2} per $\mu\text{g}/\text{m}^3$ (see EPA 1991a-b, 1994).

^f The RfD for lewisite was considered to be nonverifiable by the Strategic Environmental Research and Development Program (SERDP) Working Group; however, this value was approved as an interim value by the Army Office of the Surgeon General, pending review by the Committee on Toxicology.

^g Value estimated by Mioduszewski et al. (1998).

^h The CDC-based and current Army general population air limit is 3×10^{-6} ; recent technical evaluations suggest a potential future modification; therefore, the potentially new value of 3×10^{-7} is used here (USACHPPM 1998).

[HEAST] [EPA 1997e]) or other available references, with preference given to those most substantiated. Chronic toxicity constants for the chemical agents and the additional hazardous constituents described by this rule are not currently listed by the IRIS or HEAST. However, as described below, documentation of the necessary values for the six chemical agents is available. In addition, inferences may be drawn from this information to address other hazardous constituents included in this proposed rule. If additional data become available in the future, the DSHW intends to re-evaluate the conditions and assumptions described in this rule.

Chronic Toxicity Constants for Inhalation

The Centers for Disease Control and Prevention (CDC) has evaluated occupational and general public inhalation exposure limits for the nerve agents GA, GB, and VX; the mustard agents H, HD, and HT; and lewisite (CDC 1988). The Army has adopted these inhalation exposure standards (DA 1990, 1991). A recent technical evaluation has verified the validity of the G-agent air standards but has suggested that the VX general population limit should potentially be lowered by a factor of 10 (U.S. Army Center for Health Promotion and Preventative Medicine [USACHPPM] 1998). In this proposed rule, the lowered VX limit (3×10^{-7} mg/m³/day) was used in place of the existing standard (3×10^{-6} mg/m³/day) to ensure conservatism should standards be changed. The air standards were used as surrogate RfCs by converting them into inhalation RfDs (RfDi) using the standard exposure parameters of 20 m³/day as an adult inhalation rate and 70 kg as an adult body weight.

Chronic Toxicity Constants for Ingestion

The U.S. Army Surgeon General approved "interim" chronic toxicity values for the primary agents (i.e., HD, GA, GB, GD, VX, and lewisite) in June 1996. In 1998, the values and their derivation were published in the peer-reviewed journal *Review of Environmental Contamination and Toxicology* (Opresko et al. 1998). These values have already undergone review by a variety of organizations, including EPA and CDC. A review by the National Research Council Committee on Toxicology is expected to be finalized by May 1999. Background Document F presents the chronology of the development and review process associated with these values. Reviewers have concurred with the interim values except those for lewisite. Although an oral RfD was derived for lewisite (1×10^{-4} mg/kg/day), it was the conclusion of the Strategic Environmental Research and Development Program Working Group that this RfD was not verifiable because of deficiencies in the available toxicity data. The Working Group recommended that the RfD for inorganic arsenic (3×10^{-4} mg/kg/day) should be used instead. Because these values are so similar (in fact the lewisite value is slightly more conservative), and the fact that the lewisite RfD was allowed for use as an interim value by the Army Surgeon General, the value of 1×10^{-4} mg/kg/day was used in this proposed rule.

Dermal Chronic Toxicity Constants

Dermal chronic toxicity values are not currently available for chemical agents, as is the case with the majority of industrial/agricultural compounds. Using the EPA Region IX method (which assesses the dermal contact pathway), oral RfDs are converted to (or used as surrogates for) dermal RfDs where no other information is available (EPA 1992, 1998). In this proposed rule, available data on

acute dermal effects of the agents were used to evaluate the appropriateness of using the oral RfDs in this manner. On the basis of this evaluation (Background Document E), the conversion method was used for all the agents except lewisite. A derivation of a specific dermal toxicity value for lewisite was required because the standard EPA Region XI method for conversion of an oral RfD to a dermal RfD results in a dermal lewisite RfD of 7 μg , which is above the potential acute dermal effect level of 3.5 μg . Therefore, a dermal RfD for lewisite of 1.7×10^{-6} mg/kg/day was derived (Background Document E) from existing acute dermal toxicity data, resulting in a more conservative estimate.

Cancer Risk from Chemical Agents

No existing epidemiological or experimental data indicate that chemical agents other than HD are carcinogenic. A variety of data have been evaluated to quantify the carcinogenic potential of HD. Several different approaches have been compared (Background Document E). This evaluation yielded HD slope factors of 1.6, 5.0, 2.6, 5.3, 15.6, 9.5, and 95 (mg/kg/day)⁻¹. Because current scientific data were not available to suggest which method is most accurate, an average of these estimates was selected to represent the cancer toxicity constant. A statistical assessment of the values was used to determine that they presented a log-normal distribution. Therefore, a geometric mean was calculated, resulting in a value of 7.7 (mg/kg/day)⁻¹. This value is considered to be the best overall measure of the slope factor for HD. It should be noted that the statistical evaluation suggests that the 95 (mg/kg/day)⁻¹ value could be considered an outlier amongst the given data set. If this value is not used in the calculation, the final geometric mean based on the remaining six values would be 5.0 (mg/kg/day)⁻¹. By using the value of 7.7 (mg/kg/day)⁻¹ in the calculations in this proposed rule, additional conservatism is provided.

Chronic Toxicity Values for Additional Appendix VII Constituents

The development and documentation of chronic toxicity constants for the additional hazardous constituents included in this rule-making (not including those that are currently listed under federal RCRA Appendix VII constituents) has not been performed at this time. However, certain conservative assumptions can be made to allow the establishment of LDR concentration-based standards, as well as exemption levels, for these compounds. Should actual data on these other compounds become available, DSHW intends to re-evaluate the conservative approach described. The current assumptions for specific agents are described below.

Agent GF. The data regarding toxicity of the GF, as described in Background Documents B and E, are limited. Although the general mechanism of

toxicity for G-agents is the same, the overall degree of toxicity varies. As a conservative assumption, GF will be assumed to be as toxic as the most toxic G-agent, GD. Therefore, the GD concentration levels (LDR concentration-based standards as well as exemption levels) will be used for GF-related wastes.

HN1, HN3, Q Mustard, and T Mustard. The data regarding toxicity of these chemical agent related compounds, as described in Background Documents B and E, are again minimal. All of these compounds are similar to, or have a component of, sulfur mustard (HD). The mixture of additional compounds has reduced the overall percentage of HD. Because the chronic carcinogenic potency associated with HD will generally yield a particularly conservative (low) concentration, as a conservative assumption the toxicity of these compounds will be assumed to be equivalent to that of HD. Specifically, HD-based concentration levels derived in the rule will be used for all of these compounds as well.

Lewisite 2, Lewisite 3, and Lewisite Oxide. The data regarding toxicity of these chemical agent related compounds (as well as the hydrated form of lewisite oxide, chlorovinylarsonous acid [CVAA]), as described in Background Documents B and E, are again minimal. All of these compounds are associated with lewisite but appear to be somewhat less toxic. However, as a conservative assumption, the toxicity will be assumed as equivalent to that of lewisite, and the lewisite-based concentration levels derived in the rule will be used for these compounds as well.

EA2192. Limited toxicity data are available on EA2192, a breakdown product of VX. It is a solid in the environmental conditions of concern and would not be expected to volatilize into an inhalation hazard. The acute data that are available indicate that by other key pathways of exposure (e.g., dermal, ingestion), its toxicity is less than that of its parent compound VX. However, as a conservative assumption, its toxicity and mechanism of effect will be assumed to be equivalent to that of VX. Therefore, the LDR concentration-based standard and exemption level for VX will be applied to EA2192.

Vx. This compound, referred to as "V little x," although different than the more commonly known nerve agent VX, demonstrates some of the same basic properties of the nerve agents, and in particular that of VX. The limited toxicity data available suggest that it is less toxic than the compound VX. However, as a conservative assumption, for purposes of this rule making, the toxicity and mechanism of effect for Vx will be assumed to be equivalent to that of VX. Therefore, the LDR concentration-based standard and exemption level for VX will be applied to Vx.

DM (Adamsite). Adamsite, an arsenical-based compound, is a vomiting agent considered to be of moderate toxicity. It is not a skin irritant like lewisite,

although once inhaled it can cause upper respiratory irritation. Its chronic toxicity is unclear, although, as an arsenic-containing compound, it is currently regulated under EPA RCRA requirements (Part 261, Appendix VIII, Arsenic Compounds N.O.S. [not otherwise specified]). This incapacitating agent is a sternutator or vomiting agent. Its toxicity is considered mild compared with that of the nerve agents, although these compounds do not have the same mechanism of action. DM is not part of the military chemical stockpile and therefore may be found only in limited amounts. The Army has not developed an RfD for DM, and no existing chemicals proposed for regulation under this rule have a similar toxicity or mechanism of action as DM. At this time, therefore, no concentration standards (LDR or exemption) are proposed for DM. In addition, while treatment technologies exist for DM, because there is no proposed LDR concentration-based standard, there is no benchmark against which to consider the adequacy of the available DM treatment technologies. Therefore, there is no LDR technology proposed herein for DM. DSHW proposes, for those unique situations when DM-containing wastes are generated, to defer to the small-volume agreement approach proposed for this rule (see Preamble Section IX for details).

BZ (3-Quinuclidinyl Benzilate). This glycolate incapacitating agent is a central nervous system depressant and hallucinatory drug. It is considered a DOT Class B poison. Its toxicity is considered mild compared with that of the nerve agents, although these compounds do not have the same mechanism of action. BZ is not part of the military chemical stockpile and therefore may be found only in limited amounts. The Army has not developed an RfD for BZ, and no existing chemicals proposed for regulation under this rule have a similar toxicity or mechanism of action as BZ. At this time, therefore, no concentration standards (LDR or exemption) are proposed for BZ. In addition, while treatment technologies exist for BZ, because there is no proposed LDR concentration-based standard, there is no benchmark against which to consider the adequacy of the available BZ treatment technologies. Therefore, there is no LDR technology proposed herein for BZ. DSHW proposes, for those unique situations when BZ-containing wastes are generated, to defer to the small-volume agreement approach proposed for this rule (see Preamble Section IX for details).

b. Target Risk and Target Hazard Index

The target risk and target hazard index are unitless parameters that describe the accepted risk level for carcinogens and noncarcinogens, respectively. Both are used as single-value parameters in both deterministic and probabilistic analyses in accordance with EPA guidance.

Target Risk (TR)

The TR is the cumulative level of acceptable incremental (additional) risk of an individual developing cancer over a lifetime as a specific result of exposure to the potential carcinogen from all significant pathways for a given medium (EPA 1991a).

The National Contingency Plan (NCP), finalized by EPA in 1990, designated remediation goals to represent an excess upperbound lifetime cancer risk to an individual to be between 10^{-4} and 10^{-6} lifetime cancer risk. This range reflects the probability of 1 in 10,000 and 1 in 1,000,000, respectively, of an individual's risk of getting cancer from exposure to a specific chemical. The EPA Office of Solid Waste and Emergency Response (OSWER) Directive entitled *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (EPA 1991a) indicates that action at a site is generally warranted when the cumulative carcinogenic risk is greater than 10^{-4} ; whereas no action is required when risks fall below 10^{-6} . The decision range then, for deciding cleanup levels is between 10^{-4} and 10^{-6} .

A TR of 10^{-4} is selected as an acceptable carcinogenic risk level for workers at a hazardous waste landfill. This value is consistent with EPA guidance and actually is more stringent than the other standards established for worker protection. Specifically, the Occupational Safety and Health Act (OSHA) has identified an acceptable risk level of 10^{-3} for the workforce population (see Background Document E for additional information). This value is consistent with, if not more conservative than, Utah requirements to clean up contamination at sites to levels representing a 10^{-6} risk level, because the waste removed from such sites (i.e., wastes containing levels exceeding 10^{-6}) are disposed and or treated at RCRA Subtitle C TSD (thereby exposing the workers at these facilities to wastes potentially even exceeding a 10^{-4} risk level).

Target Hazard Index (THI)

The THI is "the level of exposure to a chemical from all significant exposure pathways in a given medium below which it is unlikely for even sensitive populations to experience adverse health effects... For noncarcinogenic effects, the NCP does not specify a range but it is generally appropriate to assume a THI equal to 1" (EPA 1991a). Therefore, a THI of 1 will be used in the calculation of the LDR concentration-based standards.

c. *Body Weight (BW)*

Body weight is given in kilograms. The values used depend on the analytical approach taken. In the deterministic analyses, a default value of 70 kg is used to represent BW. Although more recent national statistics indicate a trend toward slightly higher average adult body weights, the 70-kg default is still used as the current standard EPA default value for adults (EPA 1998). In part, use of this value reflects a more conservative assumption; it is also an assumption that is built into the establishment of certain chronic toxicity values.

For the probabilistic analyses, a distribution of weights is used. According to the EPA's most recent *Exposure Factors Handbook* (EPA 1997c), the adult population has an average weight of 71.8 kg (standard deviation of 14.6) and that is assumed to be normally distributed. The distribution of BWs amongst the landfill worker population and general population is assumed to be reasonably similar. Therefore, this distribution is used in the probabilistic approach to determine the LDR concentration-based standards.

d. *Exposure Duration (ED)*

The exposure duration (ED) parameter describes the number of years that an individual in the population may be exposed. In the hazardous waste landfill scenario, ED describes the number of years that a worker may be expected to work at the landfill. This parameter can be represented by a single conservative estimate or a range of values that describe the variability of different workers.

The most current EPA *Exposure Factors Handbook* (EPA 1997c) recommends that the median occupational tenure of the 1987 U.S. working population (109.1 million people ages 16 years and older) be used for men and women when age cannot be determined. This median value of years working in a given occupation is 6.6 years. The median tenure for the classification of "Operators, Fabricators, and Laborers" from this same population is stated as 5.5 years. This classification most closely fits the landfill worker population of concern. To account for the variability in age and to add to the conservatism of the analyses, the ED value of 10 years will be used to establish the LDR concentration-based standards.

The aforementioned data can also be used to present a distribution. If the occupational classification described above is chosen, age is the key variable. Since raw data are not available, a triangular distribution may be assumed for the variability in tenure based on age. The median for the selected occupational group is 5.5 years, but the age group medians range from 1.7 years to 14.7 years (increasing duration for older age groups). A triangular distribution may be

established, bounded by the minimum (1.7 years, for 16-24 year olds) and maximum (14.7 years, for 65+ year olds) values, with a most likely value being the pre-selected (deterministic) value of 10 years. Realistically, the true duration of exposure amongst workers is most likely lognormally distributed (skewed toward the minimum value), but without raw data, calculation of the mean and standard deviation that describe the actual curve is not possible. Therefore, the more conservative triangular distribution is used.

e. Exposure Frequency (EF)

The exposure frequency (EF) parameter identifies the number of days during a year (days/year) that an individual is exposed. For this parameter, no default standards exist for a landfill scenario. However, since the EF parameter can have a marked influence on the resulting estimated LDR concentration-based standard, a significant attempt has been made to conservatively, yet realistically, define this parameter. Because exposure to chemical agents will occur when a variety of conditions exist, in particular the misuse or malfunction of personal protective clothing and equipment (PPE), data concerning the statistics on OSHA safety violations pertaining to PPE were sought on the OSHA Internet site (OSHA 1998). Hazardous waste disposal facilities (including transport and processing) fall within the OSHA Standard Industrial Classification (SIC) 4953 - Refuse Systems. Review of individual inspections showed that during the year October 1, 1996-September 31, 1997, a total of 291 OSHA inspections were performed at U.S. facilities in the Refuse Systems classification. In those inspections, 27 citations were issued regarding the OSHA standards for PPE (OSHA Standards 19100132 — Personal Protective Equipment — General Requirements, and 19100134 — Respiratory Protection). The ratio of citations to inspections is 9%. On the basis of this information, it may be assumed that misuse or malfunction of a hazardous waste worker's PPE resulting in exposure occurs 9% of the time in any given year.

Admittedly, there are many uncertainties associated with these assumptions. For example, many inspections were conducted because of complaints, so the data set cannot be considered a random collection. Also, no detail was given regarding the subclassifications (e.g., hazardous waste disposal site, or rubbish collection and disposal) of facilities being inspected, so the percentage of those cited being hazardous waste sites is unknown. In addition, PPE citations may involve "non-exposure related" violations, such as documentation requirements. On the other hand, only using data regarding PPE does not consider the contribution of engineering control breakdown to exposure frequency.

Given these considerations, an assumed conservative estimate of 10% of the normal 250-day work-year has been proposed as the frequency of exposure at

a TSDF landfill. This assumption results in a single-value estimate of 25 days. Considering the circumstances (the same worker either not wearing PPE or donning faulty equipment, and then contacting chemical agent contaminated materials on 25 different days throughout the year for 10 years), this value is considered an extremely conservative estimate.

For purpose of deriving a distribution for the EF, there is still no quantifiable data to establish a true distribution. However, given the conservatism of the deterministic value above (a worst-case assumption), a distribution may be used to reflect potentially more likely scenarios that involve much less frequent exposures. Therefore, for the probabilistic analysis, a uniform distribution of between 0 and 25 days is used.

f. Exposure Time (ET)

The exposure time (ET) parameter is used only in the LDR_{liq} derivation. This parameters represents the amount of time a contaminated liquid matrix would remain on the skin surface area of an exposed individual. No data are available representing such conditions at the TSDF facility, and data regarding half-life and/or degradation of a chemical are not directly (empirically) incorporated into this value. Realistically, a worker who comes into contact with a liquid waste should appropriately wash immediately, thus minimizing overall exposure time to minutes. Many of the liquid matrices may be caustic, maximizing the likelihood of expedited removal and decontamination from the body. However, conditions may prevent immediate washing.

For purposes of this rule, 1 hour is used to represent the time a liquid matrix may remain on the skin of an exposed individual before washing or removal of residual contaminant. This value is based on the assumptions (common to other parameters) that these repeated occurrences and durations of exposure occur to the *same* personnel. Therefore, 1 hour is used in the deterministic calculations as a reasonable conservative value.

For the probabilistic approach, then, a 1-hour most-likely value is conservatively chosen along with a triangular distribution. A maximum value of 4 hours has been selected (based on a one-half work shift – assumes cleaning during, for example, a noon break) along with a minimum value of 0.17 hours (which equals 10 minutes).

g. Averaging Time (AT)

The averaging time (AT) parameter is described by an equation that represents the time over which the exposure is averaged (in units of days).

Different equations are used for the assessment of carcinogenic compounds vs. noncarcinogenic compounds.

For the averaging time for carcinogenic compounds (ATc), exposure is averaged over the lifetime of the individual. The current standard default average lifetime designated by EPA is 70 years. The ATc is, therefore, stated as "70 years \times 365 days/year," which equals 25,550 days. Although more recent statistics show an increase in the longevity of Americans (as of 1993 the average was 75.5 years) some of the chronic toxicity values (such as the cancer slope factor) use a 70-year lifetime. In addition, the most recent EPA Region IX PRG guidance continues to use this default of 70 years, in part because it results in a slightly more conservative estimated screening level. Therefore, the 70-year assumption is used as a singular-value, resulting in a single-value ATc for both the deterministic and probabilistic analyses in order to complement the built-in assumptions of the cancer slope factor and unit risk factor.

For noncarcinogenic compounds (ATn) the exposure is averaged over the duration of the exposure itself. Thus, ATn equals "ED \times 365 days," which equals 3,650 days when using the deterministic approach (ED = 10 years). However, for the probabilistic approach, ATn will reflect a distribution, because the ED on which it is based is represented by a triangular distribution of {1.7, 10, 14.7} years.

h. Soil Ingestion Rate (IRS)

The rate at which adults inadvertently ingest soil (IRS) (including ingestion of dust) is estimated in milligrams of soil per day. The EPA describes available information on adult ingestion rates as "very weak" (EPA 1997c). Again, use of these parameters is somewhat complicated by the use of soil as a surrogate for other solid matrices. However, it is assumed that soil would yield the highest soil/dust ingestion rates because incidental ingestion occurs when contaminated material (usually adhering to particulate matter) is ingested through hand-mouth contact or through airborne particles. These contaminated particles are more likely to be available from a soil matrix than from other solid matrices.

The standard EPA default (EPA 1989a, 1991a) for ingestion by adults is 100 mg/day. The EPA Region XI guidance suggests a default of 50 mg/day for occupational exposures, while EPA Region III suggests a default of 480 mg/day for adults engaged in yardwork or physical activity (EPA 1996a, 1997a). More recent studies (EPA 1997c) identify ranges of values, typically below the 480-mg/day estimate. For purposes of the deterministic evaluation, an IRS of 100 mg/day was selected.

The most significant study described in the most recent *Exposure Factors Handbook* (EPA 1997c) refers to a fecal tracer study. Although that study had a limited number of subjects, its advantage over other available studies is that it provides quantitative estimates of soil ingestion by adults. Weekly ingestion rates were calculated by use of eight tracer metals. On the basis of the data from that study, the American Industrial Health Council (1994) developed a cumulative distribution for adult soil ingestion rates. The rates fell between 0 and 216 mg/day, with the majority below 50 mg. Since data are limited, a conservative triangular distribution is used, with the minimum value of 0 mg/day, the most likely considered to be 100 mg/day, and the high-end value of 216 mg/day.

i. Fraction Contaminated Soil (FC)

The fraction contaminated soil (FC) parameter reflects the percentage of ingested soil that is actually contaminated with the chemical agent of concern. As with other parameters, soil is used to represent all solid waste matrices. Because this factor relates to the fractions of soils/dust available from the matrix for ingestion, this assumption is thought to add to the conservatism of the estimated LDR concentration-based standards. Because the IRS reflects the *daily* rate of ingestion, it includes ingestion of soils and dusts from sources outside of the worksite. Although it may be assumed that a majority of the landfill workers' ingested soil will come from the worksite itself, the actual portion of that soil and dust that is contaminated with chemical agent is expected to be quite small. An assessment of the percentage of chemical agent wastes from overall hazardous waste received by several waste disposal facilities in Utah from 1994 through 1997 yielded estimated annual percentages of less than 0.3%. Even if future chemical agent waste generation was to increase, the anticipated percentage to overall waste received by these facilities is not expected to exceed 1%.

Despite these predictions, the state considers this parameter an extreme unknown. Therefore, 50% FC is used for the deterministic analyses to establish the Utah LDR concentration-based standards. This value conservatively overestimates the existing percentage of chemical agent waste at the Utah facilities and is believed to conservatively overestimate the maximum percent represented by all potential future waste.

The actual FC, as stated, is very uncertain and therefore must be described probabilistically as a very wide range. The actual distribution of percentages of agent contaminated soil ingested by workers may be described as a normal, lognormal, or other shaped curve. However, without raw data, the mean and standard deviation describing the actual curve cannot be calculated. Therefore, a triangular distribution (minimum of 0%, most likely value of 1%, maximum of 50%) will be used to conservatively represent the FC in the probabilistic analyses.

j. Skin Surface Area Exposed (SA)

The area of surface skin exposed (SA) to a chemical agent or matrices containing residual chemical agent depends on the estimated area of an individual worker's body that is covered by protective clothing as well as the coverage of the areas most susceptible to exposure. The EPA estimate of exposed area for individuals wearing long-sleeved shirts, pants, and shoes is 2,000 cm² (i.e., skin surface exposed is head and hands). If skin surface exposed is increased to include forearms and lower legs, the estimated value is 5,300 cm². These two examples suggest that with clothes, 10 to 25% of the skin area may be exposed to soil or other contaminated matrices (25% of the adult skin surface area is estimated to amount to between 5,000 and 5,800 cm²). One other study in the *Exposure Factors Sourcebook* (AIHC 1994) indicates that for adults, the total estimated surface area for the hands, neck, head, and forearms is 3,420 cm². The primary areas of concern relative to the TSDF worker are the head, hands, and forearms, as well as the neck. Data for individual body areas obtained from the EPA in the *Exposure Factors Handbook* (EPA 1997c) can be added for these areas (not including the neck), resulting in a mean area (for men) of 3,160 cm². The EPA Region IX (EPA 1998) recently modified its default SA value to 5,700 cm² (which could conservatively represent the head, forearms, hands, and neck or other combination of exposed surfaces resulting in a total area equivalent to 25% of the body surface area).

Use of these estimates assumes that the clothing protects the individual from exposure. Although some studies cited by the EPA suggest that some contaminants may penetrate clothing or that exposure may occur under loose clothing, it is necessary to note that for the hazardous waste landfill workers, the type of clothing worn is expected to be more substantial than typical clothing. Under more realistic conditions, worker contact and exposure would be eliminated through proper PPE that would include coverage of the entire body (with protection of the face provided by respirator). As stated previously in this proposed rule, the actual potential for this exposure to occur, particularly repeatedly to a single individual, is very low. However, for purposes of evaluating the only plausible exposure route to a civilian population, this rule assumes that exposures might occur if gloves or respirators were removed, if clothing was ripped, or if sleeves or pants had unsecured openings.

On the basis of the above studies and considerations, the EPA Region IX default SA value of 5,700 cm² is used for the deterministic calculation of the health-based LDR concentration-based standards.

For the probabilistic analyses, statistics for individual body part surface areas provided by EPA (EPA 1997c) were consulted. The minimum, mean, and

maximum values for the head, forearms, and hands of men were summed for purposes of describing a distribution of the surface area of concern. Data for men were used because that resulted in more conservative (higher) values than would be the case if average values for men and women combined were used. The resulting minimum, mean, and maximum values are 2,441 cm², 3,160 cm², and 4,100 cm², respectively. Because the EPA data do not include the area for the neck, the estimate of 3,420 cm² given by the AIHC may be incorporated into this distribution (especially since this estimate seems to be appropriately higher than the described minimum, mean, and maximum values without the neck). A conservative SA, therefore, is represented by a triangular distribution with a minimum SA value of 2,441 cm², a most likely value of 3,420 cm², and a maximum value of 5,700 cm².

k. Soil-to-Skin Adherence Factor (AF)

The previous discussion presented information about the area of skin exposed to soil. Those values are needed to estimate the total amount of soil on skin by multiplying the SA by the soil adherence factor (AF), which is given in units of mg/cm². In general, the AF depends on soil properties (e.g., adherence increases with moisture and decreases with particle size), and varies across body parts (hands are highest) and with activity. In the absence of site-specific data, the EPA guidance recommends the following default values: 1.45 mg/cm² for commercial potting soil and 2.77 mg/cm² for kaolin clay (EPA 1989b). EPA (1992) also reported that "a range of values from 0.2 mg/cm² to 1.5 mg/cm² per event appear possible." On the basis of the most recently developed dermal exposure guidelines, EPA Region IX now uses a soil adherence value of 0.08 mg/cm² for PRG calculations for adults and 0.3 mg/cm² for children (EPA 1998). The 0.08 mg/cm² value is selected from a range of activity-specific AF values described for adults (weighted to reflect the hands, forearms, and face). Included are 10 values representing the 50% percentile AF value for 10 different activities, ranging from 0.01 to 0.20 mg/cm². Therefore, the most current EPA Region IX default AF value of 0.08 mg/cm² for adults was selected for the deterministic approach.

For the probabilistic approach, a distribution was created using the minimum and maximum value from the most recent EPA report (0.01 mg/cm² and 0.2 mg/cm²) along with the default value of 0.08 mg/cm² in a triangular distribution.

l. Skin Absorption Factor (ABS)

Once soil (or other solid waste matrices containing chemical residues) has come into contact with and is adhered to the skin, the next process to be considered is the rate of absorption through the skin (the skin absorption factor, or

ABS). The EPA default values for ABS for organic compounds include 0.01 (EPA 1995a) and 0.1 (EPA 1998). However, the ABS is highly dependent on a combination of chemical properties and soil/matrix properties. While values for certain chemical properties may be obtained or estimated, the soil/matrix properties are extremely site dependent. Thus, variability of the matrix will result in uncertainty associated with both the estimated ABS values and the resulting concentration estimates.

Background Document E presents a theoretical derivation of specific ABS values for the individual chemical agents on the basis of assumed *soil* characteristics. The use of soil characteristics to represent any anticipated solid waste matrices may result in under or over conservative estimates; however, soil is the matrix with the most data available. Table XI-2 summarizes the estimated values. These theoretical calculations are based on the assumption of an 8-hour daily exposure. These chemical-specific ABS values are used singularly for both deterministic and probabilistic analyses.

TABLE XI-2 Skin Absorption (ABS) Values for Chemical Agents^a

Agent	ABS
HD	5.6%/8 h
Lewisite	10%/8 h
GA	2.1%/8 h
GB	2.8%/8 h
GD	6.1%/8 h
VX	2.2%/8 h

^a Values are based on an 8-hour daily exposure.

m. Inhalation Rate (INH)

The health risk associated with human exposure to airborne toxins is a function of concentration of air pollutants, chemical species, duration of exposure, and inhalation rate (INH). The inhalation rate represents the rate at which an individual (in this case a landfill worker) inhales a volume of air (given as m³/day). The most significant variables affecting the INH include age (e.g., adult vs child) and the degree of physical activity. The EPA Region IX default INH value for adults is 20 m³/day. This value represents outdoor residential, agricultural, and industrial activities (AIHC 1994). More recent EPA guidance suggests 15.2 m³/day as the value to use (for men; for women the value suggested is 11.3 m³/day). Additional distribution data are provided in the AIHC *Exposure Factors Sourcebook*, which indicates a triangular distribution (minimum value of 6.0 m³/day, maximum of 32.0 m³/day, and most likely value of 18.9 m³/day) for adult (male and female) air intake rates.

The default value of 20 m³/day exceeds the more recently recommended adult INH value and will be used as the deterministic input parameter.

For the probabilistic approach, variability will be addressed by applying the triangular distribution cited above (6.0 m³/day, 18.9 m³/day, 32.0 m³/day).

n. Volatilization Factor (VF) and Particulate Emission Factor (PEF)

To address the soil-to-air pathway, the risk assessment equations incorporate volatilization factors (VF) for volatile contaminants and particulate emission factors (PEF) for nonvolatile contaminants. As with certain other parameters, the use of soil as a surrogate for all anticipated solid wastestreams adds to the uncertainty of the final estimated LDR concentration-based standards. The VF and PEF parameters relate soil contaminant concentrations to air contaminant concentrations that may be inhaled on-site. The calculation of these two parameters models the emission of the contaminant from the soil as well as the dispersion of the contaminant into the atmosphere. Both parameters are typically represented as a single deterministic estimate even in probabilistic analyses.

Volatilization Factor (VF)

Volatilization of chemicals from soil is estimated for those chemicals that have a Henry's Law constant greater than 10^{-5} (atm³/mol) and a molecular weight less than 200 g/mole. Of the chemical agents being considered, only sulphur mustard (HD) meets this definition of a volatile compound; all other agents (in soil) are considered as nonvolatile compounds for purposes of the risk assessment process. Therefore, the PEF is used to calculate LDR concentrations for these compounds. For HD, a chemical-specific VF can be derived from the equation provided in the EPA Region IX guidance (EPA 1998). Background Document E (Appendix A) presents these calculations. The VF calculated for use in deriving health-based LDR concentrations for HD is 5.6×10^4 m³/kg.

Particulate Emission Factor (PEF)

For chemicals falling into the nonvolatile category, inhalation of chemicals adsorbed to respirable particles is assessed by using a default value of 1.32×10^9 m³/kg for the PEF parameter (EPA 1998). This value relates the contaminant concentration in soil with the concentration of respirable particles in air due to fugitive dust emissions. This relationship was derived for typical hazardous waste sites where the surface contamination provides relatively continuous and constant potential for emission over an extended time (e.g., years). The default PEF value of 1.32×10^9 m³/kg is therefore used to calculate the LDR concentrations for the compounds GA, GB, GD, VX, and lewisite.

o. Permeability Coefficients (PCS)

Dermal permeability coefficients (PCS) are chemical-specific values used in the LDR_{liq} equation. Experimentally derived dermal PCS were not located in the

available literature for any of the chemical warfare agents. In such cases, EPA (1992) recommends the use of the following algorithm:

$$\log K_p = -2.72 + 0.71 \log K_{ow} - 0.0061 MW \quad (XI-5)$$

where

K_p = permeability coefficient (PC),

K_{ow} = octanol/water partition coefficient (chemical-specific), and

MW = molecular weight.

The $\log K_{ow}$ values, molecular weights, estimated PC values, and RfD_o values for the chemical agents are listed in Table XI-3. A $\log K_{ow}$ value is not available for lewisite because it undergoes rapid hydrolysis in aqueous solutions; therefore, the $\log K_{ow}$ value for its primary breakdown product (CVAA) was used to calculate the PC for lewisite.

4. Calculations

The insertion of the parameters identified in Tables XI-4 and XI-5 into the described equations results in the ranges of concentrations shown in Tables XI-6 and XI-7. Included are those values derived using both the deterministic and

TABLE XI-3 RfD_o s Values, Molecular Weights, $\log K_{ow}$ Values, and Permeability Coefficients (PCS) for the Chemical Warfare Agents

Agent	RfD_o (mg/kg/day)	Molecular Weight	$\log K_{ow}^a$	PC
HD	7×10^{-6}	159.04	1.37	0.00192
VX	6×10^{-7}	267.4	2.09	0.00136
GA	4×10^{-5}	162.1	1.18	0.00037
GD	4×10^{-6}	182.2	1.02	0.00289
GB	2×10^{-5}	140.1	0.15	0.00043
Lewisite	1.7×10^{-6}	207.32	-	0.000092
CVAA ^b		170.427	-0.07	0.00015

^a See Background Document E regarding $\log K_{ow}$.

^b 2-chlorovinylarsonous acid (hydrolysis product of lewisite) is used to provide a surrogate $\log K_{ow}$ for lewisite.

TABLE XI-4 Description of Selected Exposure Parameters for LDR_{sol} Concentration-Based Levels

Parameter	Deterministic Approach – Single values	Probabilistic Approach – Distributions
Chronic toxicity value	See Table XI.1	See Table XI.1 ^a
Risk index (THI or TR)	THI = 1; TR = 10^{-4}	THI = 1; TR = 10^{-4} ^a
Body weight (BW)	70 kg	Normal {mean = 71.8, stdev = 14.6}
Exposure duration (ED)	10 years	Triang{min = 1.7, most likely = 10, max = 14.7}
Exposure frequency (EF)	25 days/year	Uniform{min = 0, max = 25}
Averaging time (AT)	[ED × 365 days/yr] (use 70 yrs for ED for carcinogens) = 3,650 days (for nc) or 25,550 days (for cancer)	[ED × 365 days/yr] (use 70 yrs for ED for carcinogens)
Inhalation rate (IHR)	20 m ³ /day	Triangular{min = 6.0, most = 18.9, max = 32}
Ingestion rate (IRS)	100 mg/day	Triangular{ min = 0, most = 100, max = 216}
Fraction contaminated (FC)	50%	Triangular{min = 0, most likely = 1%, max = 50%}
Skin area exposed (SA)	5700 cm ²	Triangular{min = 2441, most = 3420, max = 5700}
Soil-to-skin adherence (AF)	0.08mg/cm ²	Triangular{min = 0.01, most = 0.08, max = 0.2}
Skin absorption (ABS)	Chemical specific, 8-h daily exposure; see Table XI-2, Background Document E	Chemical specific, 8-h daily exposure; see Table XI-2, Background Document E
Volatilization/particulate emission factor	VF for HD = 5.6×10^4 m ³ /kg. PEF for other agents = 1.32×10^9 m ³ /kg	VF ^a for HD = 5.6×10^4 m ³ /kg. PEF ^a for other agents = 1.32×10^9 m ³ /kg

^a Indicated parameters are identified by only single, descriptive values (not distributions).

TABLE XI-5 Description of Selected Exposure Parameters For LDR_{eq} Concentration-Based Levels

Parameter	Deterministic Approach – Single values	Probabilistic Approach – Distributions
Chronic toxicity value	Chemical specific, see Table XI.1	Chemical specific, see Table XI.1 ^a
Risk index (THI or TR)	THI = 1; TR = 10^{-4}	THI = 1; TR = 10^{-4} ^a
Body weight (BW)	70 kg	Normal {mean = 71.8, stdev = 14.6}
Exposure duration (ED)	10 years	Triangular{min = 1.7, most likely = 10, max = 14.7}
Exposure frequency (EF)	25 days/year	Uniform{min = 0, max = 250}
Exposure time (ET)	1 hour	Triangular{min = 0.17, most = 1, max = 4}
Averaging time (AT)	[ED × 365 days/yr] (use 70 yrs for ED for carcinogens) = 3,650 days (for nc) or 25,550 days (for cancer)	[ED × 365 days/yr] (use 70 yrs for ED for carcinogens)
Skin area exposed (SA)	5,700 cm ²	Triangular{min = 2441, most = 3420, max = 5700}
Skin absorption (ABS)	Chemical specific, 8-h daily exposure; see Table XI-2	Chemical specific, 8-h daily exposure; see Table XI-2
Permeability coefficient (PC)	Chemical-specific, see Table XI-3	Chemical-specific, see Table XI-3 ^a

^a Indicated parameters are identified by only single, descriptive values (not distributions).

TABLE XI-6 Proposed LDR_{sol} Concentration-Based Standards (mg/kg or ppm)

Chemical Agent	Proposed LDR_{sol} Concentration-Based Standards – Deterministic Approach	Supporting Probabilistic Approach Estimates
HD	6.7	6.2
GA	680	1,100
GB	320	490
GD	52	76
VX	10	16
Lewisite	37	35

**TABLE XI-7 Proposed LDR_{10q} Concentration-Based Standards
(mg/L or ppm)**

Chemical Agent	Proposed LDR _{10q} Concentration-Based Standards – Deterministic Approach	Supporting Probabilistic Approach Estimates
HD	0.7	0.4
GA	20	12
GB	8.3	5.1
GD	0.3	0.15
VX	0.08	0.05
Lewisite	3.3	2.2

probabilistic approaches. The proposed LDR concentration-based standards are represented by the values derived using the deterministic approach; supporting probabilistic-based estimates are also presented. As described previously, each approach offers advantages and disadvantages, but both are considered to provide reasonable estimates of an appropriately acceptable concentration. Documentation of the Monte Carlo simulation, along with graphical portrayals of the parameter distributions used in the probabilistic analyses, is presented Background Document G.

5. Uncertainties

The concentrations presented depict a range of values that are considered to offer an adequate level of protection to the population of concern. However, the process of risk assessment cannot provide an *exact* identification of the specific concentration of chemical in a waste that, when exceeded, will pose a definitive risk that would result in an adverse health effect. Human variability and sensitivities alone account for some of the uncertainty. However, each assumption in the model is a variable and, depending on the availability and quality of data upon which these variables are based, there may be greater or lesser uncertainty in the resulting calculated values. Therefore, the risk calculations described above are derived with assumptions that tend to result in conservative values. Despite its limitations and the uncertainties, the process used is consistent with that currently used by the EPA in assessing potential chronic health effects from chemical exposures.

Because of the uncertainties associated with the models, the approach (deterministic versus probabilistic), and the assumptions themselves, it should be noted that the actual estimated values should not scientifically be represented by any more than one significant digit. However, because EPA screening levels (including those of EPA Region IX) are represented with two significant digits, two

significant digits are also used for this rule-making. It should be noted that the actual preciseness associated with this degree of certainty, however, is limited to one significant digit.

While the results of the probabilistic analyses are somewhat different than those of the deterministic approach, the relative differences are not substantial. For HD and lewisite, the values are quite similar, while the values for G-agents and VX are about a third of an order of magnitude higher using a probabilistic approach. Although both approaches are scientifically valid ways of determining these health-based values, each is based on a variety of assumptions with which there is associated uncertainty as to the accuracy of each parameter. These uncertainties are inherently associated with the risk assessment process and are addressed in the discussion of the selection of individual parameters. While the deterministic approach does not provide a mechanism to quantify the total uncertainty associated with the estimated concentration level, a qualitative discussion and summarization of the types and degrees of uncertainty may be presented.

Table XI-8 summarizes some of the key uncertainties associated with the use of the model and the selected parameters in calculating the LDR concentration-based standards. By yielding a distribution of concentrations (as demonstrated in Figure XI-1), the probabilistic approach inherently demonstrates a quantified degree of uncertainty (or the degree of certainty) associated with a range of calculated LDR concentration-based standards. (In the case of this proposed rule, the upper 95% degree of certainty is associated with the selected value). However, this degree of certainty is itself based on the assumption that the distributions used in the calculations accurately define the true parameters that represent the exposure scenario of concern. Because several parameter distributions themselves are described by assumed data or data that do not definitively describe the population/exposure scenario of concern, there is an additional, unquantified uncertainty associated with the probabilistic approach.

F. DERIVATION OF EXEMPTION LEVELS

As previously discussed, exemption levels are to be applied when determining whether chemical agent related wastes can be exempted from hazardous waste regulatory requirements and instead be managed under RCRA Subtitle D requirements, so long as there are no other chemical characteristics or constituents that would require that the wastes retain a hazardous waste classification.

TABLE XI-8 Uncertainty Summary — Key Areas of Uncertainty and Type of Effect on "Conservatism" of LDR Concentration-Based Standards

Type of Uncertainty	Type of Effect ^a
Chronic toxicity constants	Assumed overly conservative because of built-in safety factors; extreme data limitations associated with lewisite make this value most questionable though certain modifications have attempted to address; these values have significant impacts on resulting LDR concentration-based standards.
Use of additive multiple exposure pathway model for soil	Assumed overly conservative (particularly for vesicants HD and lewisite).
Exposure duration (ED)	Varied - possible over/under conservatism; primarily effects HD value.
Exposure frequency (EF)	Overly conservative; depends on compliance with occupational requirements; this parameter has major impacts on the calculations (i.e, the resulting estimate is very sensitive to this input value).
Skin surface area exposed (SA)	Overly conservative; depends on compliance with occupational requirements.
Use of soil as surrogate matrix (affects parameters such as ABS, IRS, FC, and VF, PEF)	Varied - possible over/under conservatism.
Fraction ingested from contaminated source (FI)	Overly conservative.
Permeability coefficient (PC)	Varied – assumed over conservative.

^a Type of effect has been determined by professional judgment.

1. General

Waste determined not to pose a risk to the civilian workforce anticipated at Subtitle D landfill operations will have to be demonstrated to contain levels of agent at or below the exemption levels described herein. These are criteria for determining cleanup decisions at industrial-use cleanup sites. Although no longer hazardous waste, exempted waste must meet state-implemented Subtitle D requirements. This waste management option requires certain tracking and management provisions, although of a less stringent nature than that for hazardous wastes.

2. Methodology and Assumptions

The EPA Region IX risk models used in this rule-making were derived for assessing the need for environmental cleanup at contaminated sites. The assessments are dependent on the type of current and/or future land use, to include residential or industrial settings. Chemical agent health-based environmental screening levels (HBESLs) derived from the EPA Region IX guidance (as well as other EPA methods) have been documented in Background Document E. These screening level values were calculated with a deterministic approach, as has been done by Region IX for hundreds of industrial chemicals. The chemical agent HBESLs for industrial sites are proposed as appropriate levels for determining whether wastes pose a risk warranting strict management and oversight under RCRA Subtitle C or whether they can instead be safely managed under the state-implemented RCRA Subtitle D requirements. The calculations used are those previously described for nonwastewater solids. Exemption criteria are not established for nonwastewater liquids or wastewaters. Tables XI-9 and XI-10 summarize the specific parameters and resulting concentration values for use as exemption criteria from RCRA Subtitle C regulations. Specific discussion of the selection of these different parameters is contained in Background Document E.

TABLE XI-9 Description of Selected Exposure Parameters for Waste Exemption Levels (for solid nonwastewaters only)

Parameter	Exemption Level Assumptions
Chronic toxicity dose	See Table XI.1
Risk index (THI or TR)	THI = 1; TR = 10^{-4}
Body weight (BW)	70 kg
Exposure duration (ED)	25 years
Exposure frequency (EF)	250 days/year
Averaging time (AT) ^a	9,125 days for noncarcinogens 25,550 days for carcinogens
Inhalation rate (IHR)	20 m ³ /day
Ingestion rate (IRS)	100 mg/day
Fraction contaminated (FC)	50%
Skin area exposed (SA)	5,700 cm ²
Soil-to-skin adherence (AF)	0.08
Skin absorption (ABS)	Chemical specific, 8-h exp/d
Volatilization/particulate emission factor	VF for HD = 5.6×10^4 m ³ /kg PEF for other agents = 1.32×10^9 m ³ /kg

^a AT = [ED × 365 days/yr] (use 70 yrs for ED for carcinogens).

TABLE XI-10 Waste Exemption Levels (for solid nonwastewaters only)

Chemical Agent	Exemption Levels (mg/kg, or ppm)
HD	0.3
GA	68
GB	32
GD	5.2
VX	1.1
Lewisite	3.7

XII. ANALYTICAL METHODS AND ANALYTICAL CONSIDERATIONS

Analytical methods are the key means by which the Army will demonstrate that it has complied with the provisions of today's proposed rule. If the land disposal restriction (LDR) concentration-based standard is applied, rather than the technology-based standard, the Army will need to analyze the treated residues to show that they have met the treatment concentrations. In addition, analyses will be required if the Army wishes to demonstrate that wastes, either as generated or as a result of treatment, meet exemption levels. The analytical methods that will be used to comply with this proposed rule are discussed below.

A. Introduction

The U.S. Environmental Protection Agency (EPA) has developed numerous analytical methods that are used by the regulated community to demonstrate compliance with the Resource Conservation and Recovery Act (RCRA). These methods are provided in *Test Methods for Evaluating Solid Wastes, SW-846* (EPA 1996d), along with quality assurance and quality control (QA/QC) requirements and other information. EPA published the most recent version of SW-846 in December 1996. Several proposed and final updates have also been issued. The methods and other information in SW-846 are provided to the regulated community as guidance and, with some exceptions, are not incorporated into the RCRA regulations. Furthermore, with the exception of mustard (HD), SW-846 does not include methods for the chemical agents. However, the same general methods and techniques used in SW-846 are applicable to the agents and associated compounds.

Analytical methods themselves are not being proposed as part of today's rule. The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has decided instead to adopt the EPA approach, whereby the analytical methods to be used to comply with the rules are instead provided as guidance to the regulated community. Unlike the EPA, however, DSHW is not in the business of developing analytical methods for any constituents. It is the Army that has developed and uses analytical methods for the chemical agents. DSHW must, therefore, rely on the Army for these methods. DSHW can nevertheless require that the methods to be used to comply with the rule meet certain criteria. These criteria are proposed in today's rule.

B. APPROACH TO ANALYTICAL METHODS

The premise behind DSHW's proposed approach on analytical methods for the Utah Chemical Agent Rule (UCAR) is twofold:

- Methods should be sufficiently sensitive to detect chemicals at or below the action level concentrations that are proposed in the UCAR.
- Methods should be sufficiently validated, meaning that supporting data should demonstrate that the methods are sufficiently precise, accurate, and reproducible to support decision making.

As indicated elsewhere in today's preamble discussion, two types of action levels are being developed: LDR concentration standards and exemption levels. Because the proposed exemption levels are lower than the LDR levels, it will be most important for analytical methods to be sufficiently sensitive to "reach" the exemption levels. If the methods are this sensitive, they will automatically be acceptable for the LDR levels.

C. BACKGROUND

A number of activities with respect to analytical methods are relevant to the UCAR. These activities are discussed below:

- *Development:* Method development typically involves new analytical technologies and may include development and testing of new instruments or instrument components (EPA 1995c). It may also involve adapting existing technologies to new analytes.
- *Validation:* Method validation [often called method certification (USATHAMA 1990) or verification (DOE 1994)] involves the generation of performance data, typically on multiple sample matrices, to establish key performance measures of developed methods, such as detection/quantitation limits, precision and accuracy (EPA 1995c). Method development and validation are separate activities but often proceed along concurrent tracks.
- *Modification:* Modification of developed and/or validated methods may be desirable for a number of reasons, such as

increasing analytical sensitivity (i.e., lower detection limit), or modification to address new or problematic waste matrices (e.g., matrices with interfering substances). Substantive changes in a method as a result of modification may result in the need for revalidation.

- **Demonstration:** When a laboratory initially obtains a validated method from a standard-setting organization such as the EPA, the laboratory will typically demonstrate that it can obtain acceptable results using that method (EPA 1996d; USATHAMA 1990; DOE 1994). This process is also often termed "method validation;" DOE refers to this process as method qualification (DOE 1994); EPA and USATHAMA refer to it as a method proficiency determination (EPA 1996d; USATHAMA 1990). To differentiate this activity from the method validation referred to above, this Preamble section refers to this activity as a "method proficiency determination."

The Army Environmental Center (AEC) has published a document dealing with analytical methods that was intended to replace the 1990 USATHAMA guidance referenced above. The AEC document, entitled *U.S. Army Environmental Center Guidelines for Implementation of ER 1110-1-123 for USAEC Projects* (AEC 1993), does not specifically address the acceptability of any given method for a particular application. The guidelines instead specify that methods be selected from the EPA Contract Laboratory Program (CLP) list of methods, from SW-846, or from other EPA method compilations. The AEC document further indicates that if an analyte of interest is not addressed in any of these sources, AEC will provide a suitable methodology, if available.

It is also important to make a distinction here between methods and Standing Operating Procedures (SOPs). Methods are generic descriptions of techniques, instrumentation, reagents, etc., whereas SOPs are precise, step-by-step instructions for running the methods that laboratories develop to tailor the analyses to their specific configuration. It follows, therefore, that every SOP (or family of SOPs) should be traceable back to a specific method.

Another distinction also is important. Most methods for waste matrices consist of both an extraction method and a determinative method. The extraction method pertains to the means by which the analyte is "extracted from the waste matrix," and the determinative methods pertains to the manner in which the "extract is analyzed and the analyte quantitated." Typically, extraction is solvent-based, and the determinative phase uses some type of chromatography, such as gas chromatography (GC).

As indicated above, the EPA has developed and validated many analytical methods in support of the hazardous waste rules under RCRA (EPA 1996d). Although these methods are not relevant to today's proposed rule (with the exception of analysis of mustard), it is important to review EPA's system for development and use of these methods, because DSHW and other state regulators typically rely on EPA for direction in this area.

EPA has provided specific information to method developers in *Guidance for Method Development and Methods Validation for the RCRA Program*. In accordance with that document, there are two levels of method development/validation currently followed by EPA in developing and validating methods for SW-846:

- Preliminary validation or "proof of concept," which is an examination of method, precision, accuracy, and reproducibility, typically conducted within a single laboratory; and
- Formal validation, which is a far more extensive examination of the method, culminating in a multi-laboratory study of method performance.

Both method development/validation approaches utilize three basic principles for demonstrating the validity of the method:

- Step 1: Identify the scope and application of the proposed method (what is the method supposed to accomplish?).
- Step 2: Develop a procedure that will generate data that are consistent with the intended scope and application of the method.
- Step 3: Establish appropriate quality control procedures that will ensure that when the proposed procedure is followed, the method will generate the appropriate data from Step 2 that will meet the criteria established in Step 1.

In some cases, such as a variation of an existing SW-846 method using new equipment or a modified sample extraction procedure, validation to the proof of concept stage is sufficient (EPA 1995c). For new technologies, formal validation is required. If a method developer successfully demonstrates that a modified method appears to be applicable for its intended use through the proof of concept stage, EPA will consider incorporating the modified method into SW-846 (EPA 1995c).

Formal validation, which typically includes multilaboratory studies, are usually required for a new method to be considered for inclusion in SW-846 (EPA 1995c).

This controlled system for method development and validation has existed since the early 1980s. More recently, EPA has been pursuing an alternative "performance-based approach" to analytical methods, whereby general performance objectives for use of analytical methods in specific applications would be established, and users would merely need to ensure that the methods used meet these objectives. The performance-based approach for analytical methods at present is EPA's primary focus. It is expected that general performance objectives will be established and that the methods in SW-846 will be offered as examples of methods that meet these objectives. In accordance with the performance-based approach, non-SW-846 methods presumably could be used as long as they are demonstrated to meet the performance objectives.

New analytical technologies are unlikely to be needed to support the UCAR because the Army has and currently uses conventional and EPA-validated determinative methods and instrumentation [e.g., gas chromatography (GC), and gas chromatography/mass spectroscopy (GC/MS)] to analyze for chemical agents and associated chemicals in multiple waste matrices. New analytical methods and formal method validation to support the UCAR are therefore not needed. However, DSHW believes that all of the Army's existing methods that will be used to comply with the UCAR should be sufficiently validated (to the proof of concept level) or should otherwise be demonstrated to be capable of producing acceptable data. In addition, method detection limits must be able to achieve the action levels that will be established in the UCAR.

D. ANALYTICAL CONSIDERATIONS

There are a number of basic issues that were considered by DSHW in determining approaches for analytical methods to be used by the Army in complying with today's proposed UCAR. These are discussed below.

1. Guidance vs. Regulation

Methods are an important part of regulatory programs because they are used to demonstrate compliance. Under EPA's program, methods currently are established in SW-846 "as guidance." In actual situations, chemists must have the flexibility to make slight to moderate adjustments to these methods in order to adapt them to real waste matrices. DSHW therefore proposes that actual methods be kept as guidance, and they are therefore not proposed as part of today's proposed regulation.

2. Risk-Based Standards vs. Analytical Sensitivity

In the past, EPA has developed standards that are below the capability of analytical methods to detect. In this case, EPA has "capped" the standard at the limit of quantification (*Proposed Hazardous Waste Identification Rule, 60 FR 66344, December 21, 1995*). Today's proposed rule contains no standards that are known to be below the limit of analytical detectability in most applications. However, there may be certain complex waste matrices in which the limit of detectability may be higher than expected. It is therefore possible that some of the action levels proposed today may be below limits of detectability with some waste matrices.

DSHW believes that caps based on the limits of detection or quantitation should not be permitted for today's proposed rule. Otherwise, for example, wastes could be determined to meet LDR or exemption levels that actually exceed the relevant action level. DSHW therefore proposes that such wastes would not be presumed to pass the action levels. In this event, methods may be developed or modified by the Army that are capable of reaching these levels. In the interim, the technology-based LDR standard, as described earlier, would be applied. In that case, wastes would not need to be analyzed to demonstrate compliance. However, it must also be recognized that the waste would not qualify for exemption (where application of analytical methods with detection capabilities below the exemption level would be required). While it would meet the LDR technology-based standard and could therefore be land-disposed, the waste would remain a hazardous waste.

3. Performance-Based Approach vs. Controlled (SW-846) Type Approach

The general background discussion above described the prescriptive (SW-846) and performance-based approaches to analytical methods. EPA seems to be migrating toward a performance-based approach. It must be recognized that EPA's charge includes all waste streams generated by all industries, nationwide. For this broad responsibility, a performance-based approach makes sense. This proposed rule, on the other hand, deals with a smaller universe with chemical agents. A relatively small number of analytes (from a regulatory perspective) and a small number of waste matrix types are involved. In this situation, a prescriptive approach makes more sense. In addition, prescriptive approaches can be built with the flexibility to accommodate performance-based objectives, when appropriate. A hybrid approach that provides specific methods for specific applications, but where flexibility allows performance-based methods to be pursued where appropriate, will be pursued by DSHW. Nevertheless, methods will not be incorporated into DSHW rules. As with EPA, methods will be available as guidance only.

4. Detection vs. Quantitation Limits

As indicated above, the first objective that is proposed for analytical methods that are used to support the UCAR is that they be sufficiently sensitive to detect chemicals at or below the action level concentrations that are proposed in the UCAR. On the surface it would seem that methods are sufficiently sensitive when they are capable of "seeing" the analyte at the exemption level. The issue is more complex than that, however, because two basic measures of method sensitivity are commonly applied: the detection limit (DL) and the quantitation limit (QL). The DL (often called method detection limit, or MDL) represents the minimum concentration of analyte that the method is capable of determining is present in the matrix at a concentration greater than 0 with some degree of confidence (e.g., 95%). The QL (often called practical quantitation limit, or PQL), on the other hand, represents the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The QL is often estimated by multiplying the DL by a factor of from 3 to 5.

The standard practice for environmental measurements varies as a function of EPA region and state. Recently, however, many regulators are deferring to the QL, as these levels are more legally defensible. On the other hand, the DL is the more conservative (environmentally protective) level. DSHW prefers to defer to the DL, especially when the exemption level is applied.

DSHW wishes to also note that different organizations often apply different definitions for the DL and QL (and related) terms. For the DL, the definition is provided below. This definition is not part of the proposed rule, however, as DSHW believes that these terms should be established through guidance. In this manner, they may be adjusted as science and technology advance.

5. Validation and Historical Performance

The second objective proposed for analytical methods that are used to support the UCAR is that they be sufficiently validated, meaning that supporting data should demonstrate that the methods are sufficiently precise, accurate and reproducible to support decision-making. The questions here are how much validation is enough and when is a method sufficiently validated.

DSHW believes that performance objectives should be established up-front for all methods. A minimal set of requirements for a validated method will therefore be applied. These proposed validation requirements are discussed below.

a. Annual Demonstration of Sensitivity

Method sensitivity is demonstrated by determining the MDL, as described in 40 CFR 136, Appendix B. The MDL, as defined in Appendix B, is the lowest concentration level that can be determined to be statistically different from a blank at the 99% confidence level. The MDL is experimentally determined at least annually by preparing seven or more low-level (1-5 times the estimated MDL) interference-free replicate samples and processing them through the entire analytical sequence, to include sample preparation (e.g., extraction) as well as the determinative method.

The MDL is calculated using the following formula:

$$\text{MDL} = (t)(s)$$

where

t = student's t statistic

s = the standard deviation of at least seven replicate results.

In the use of GC/MS methods, it is necessary to determine an MDL taking into account the intensity of less sensitive mass ions so that detection can be confirmed at the resulting limit. When agent analysis is being performed with the GC/MS in the "selected-ion monitoring" (SIM) mode, the least sensitive monitored ion is recommended for use in the MDL calculation defined above. The limit so determined is then verified by the analysis of a standard prepared at the concentration calculated. If the standard can not be detected with adequate confirmation from its mass spectrum, then the limit is raised to a point that identification can be confirmed by the mass spectrum.

b. Initial Demonstration of Precision and Accuracy

Each laboratory should demonstrate initial proficiency with each combination of sample preparation and determinative methods that it utilizes. This demonstration is accomplished by generating data of acceptable accuracy and precision using four reference samples containing the target analytes in a clean matrix. The laboratory must also repeat this demonstration whenever new staff members are trained or significant changes in instrumentation are made. The process is outlined below.

Preparation of Reference Samples: The reference samples are prepared from a spiking solution containing each analyte of interest. The reference sample spiking solution may be prepared from pure standard materials or purchased as certified

solutions. If prepared by the laboratory, the reference sample spiking solution must be made from stock standards prepared independently from those used for calibration.

Preparation of the reference sample spiking solution is dependent upon the method being evaluated. In some cases, guidance for preparing the spiking solution may be found in the description of the analytical method. In the absence of method guidance or project-specific considerations, the reference sample spiking solution should be prepared in a suitable solvent at a concentration such that the spike will provide a concentration in the clean matrix that is 10 to 50 times the MDL for each analyte in that matrix.

Analysis of Reference Samples: To evaluate the performance of the total analytical process, the reference samples must be handled in exactly the same manner as actual samples. At least four replicate aliquots of the well-mixed reference samples should be analyzed by the same procedures used to analyze actual samples. This process will include a combination of the sample preparation (e.g., extraction) method as well as the determinative method.

Evaluation of Results: The average recovery (\bar{x}) and the standard deviation of the recovery(s) should be calculated for each analyte of interest using the four results. Multiple-laboratory performance data or single-laboratory performance data are included in some analytical methods and may be used as guidance in evaluating performance in a single laboratory. Even when the analytical method contains performance data (either multiple-laboratory or single-laboratory), the development of in-house acceptance limits is strongly recommended. In the absence of any performance data, an accuracy of $\pm 30\%$ for organic compounds or $\pm 20\%$ for inorganic compounds may be used as a starting point until in-house acceptance limits are developed.

The values of s and \bar{x} are compared for each analyte with the corresponding reference data for precision and accuracy. If s and \bar{x} for all analytes of interest meet the appropriate acceptance criteria, then the system performance is acceptable and analysis of actual samples can proceed. If any individual s value exceeds the precision limit or any individual \bar{x} value falls outside the range for accuracy, then the system performance is unacceptable for that analyte. The analyst should locate and correct the source of the problem and repeat the test for all analytes of interest.

The large number of analytes in some of the analytical methods presents a substantial probability that one or more analytes will fail at least one of the performance criteria when all analytes of a given method are determined. After the first such failure, the test is repeated only for those analytes that did not meet

criteria. Multiple failures, however, indicate a general problem with the measurement system. If this occurs, the problem should be corrected and then the method should be revised for all compounds of interest.

Guidance to the Performance and Presentation of Analytical Chemistry Data:

- The instrument detection limits (IDL) must be established before any field samples are analyzed. The IDLs should meet the specified requirements in the analytical methods.
- Guidance outlined in EPA Method 8000B entitled Determinative Chromatographic Separations is the recommended starting point for all chromatographic analysis. The major issue with this and all EPA type guidance is the lack of information on how to treat reactive matrices. For example, hygroscopic compounds react with moisture to form a different compound. The detection of the starting compound becomes impossible unless high concentrations of the material are present. To address these types of issues divergence from the standard spike and recovery protocols is necessary. These kinds of problems must be discussed on a case-by-case basis.
- Major defense initiatives should establish a laboratory quality assurance plan (LQAP). Generally speaking, these plans discuss data quality objectives that can exceed the analytical methods validation criteria. In these particular cases, the method criterion is superseded by the LQAP. The plans outline what is required for daily operation of plant, laboratory, monitoring, field sampling, and other testing involving an analytical method. In such cases, an analytical method must be able to meet those requirements.
- For detection limit and method validation, the Army has adopted a means of determining an MDL, target action level (TAL), and limit of quantitation (LOQ) that has been the Army standard for many years. This approach takes the information obtained from a linear regression plot and allows the researcher to assign the values on the basis of the best fit of the data. The process has been incorporated with other checks to validate analytical methods. It is still in use and is part of many Army analytical methods, including methods for the preparation of "Chemical Agent Standard Analytical Reference Material." In addition, American Society for Testing and Materials (ASTM 1989a)

designation E1323-89, *Standard Guide for Evaluating Laboratory Measurement Practices and the Statistical Analysis of the Resulting Data*; and ASTM (1989b) designation D4210-89, *Standard Practice for Intralaboratory Quality Control Procedures and a Discussion on Reporting Low-Level Data* are considered and applied when necessary.

Detection limit and validation requirements, as defined herein, will be applied by DSHW for new methods that the Army develops; they will not be applied retroactively to existing methods. Many of the Army's methods have been in existence for years. While these methods are known to produce acceptable data, the Army may not have retained records demonstrating their validation status. If a method has been successfully used by the Army in the past, and if matrix spikes applied during routine application demonstrate acceptable recoveries, the method will be accepted as validated, regardless of whether a formal validation data package is available. In many cases with reactive matrices, the spike and recovery data are performed on a non-reactive synthetic matrices or a matrix in which the reactivity has been removed through some treatment step (e.g., pH adjustment, post-extract spiking, and use of water/salt water as the baseline nonreactive system). In the case of solids, sludges, and activated carbon, a nonreactive material such as sand is often utilized.

6. Quality Assurance/Quality Control (QA/QC) Program

The Army's laboratories that conduct agent analyses are required to develop and implement laboratory-specific QA/QC programs based on the International Standards Organization (ISO) 9000 standards. A generic QA/QC program (application of ISO 9000 standards) is being implemented.

XIII. IMPLEMENTATION

The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) and the Army have been operating under the existing Utah hazardous waste provisions since 1988. A transition period will be needed in order to provide the state and the Army with sufficient time to implement the new Utah Chemical Agent Rule (UCAR). This section of the preamble discusses implementation.

A. EFFECTIVE DATE

DSHW proposes that the UCAR will become effective 9 months after publication of the final rule. Facilities affected by the rule will be required to submit an updated permit plan approval or, if appropriate (for new permits), a revised permit application to the DSHW within 9 months (270 days) of issuance of the final rule. A period of 9 months is needed because of the magnitude of this rule and the changes to existing permit plan approvals and pending permit plan approval applications that will be necessary.

B. WASTES IN STORAGE AS OF EFFECTIVE DATE

As indicated previously, the primary Army facilities in Utah that generate, treat, store, or dispose of chemical agent associated waste include the Deseret Chemical Depot (DCD), Tooele Chemical Disposal Facility (TOCDF), Chemical Agent Munitions Disposal System (CAMDS), and Dugway Proving Ground (DPG). The missions of these facilities were discussed in Preamble Section VIII. DCD's primary mission, being an Army depot, is storage of chemical munitions. Many of these chemical munitions, such as the M55 rockets (loaded with agent GB), are currently defined as waste and regulated under the P999 hazardous waste code. DCD also stores many other waste types, including those presently classified as F999. Many of these waste streams were generated at TOCDF and CAMDS in the past. Some of these waste types have been stored for extended periods of time, pending available on-site or off-site treatment options.

Wastes generated after the effective date of the rule are required to use the new waste codes as identified in the final rule. However, DSHW is proposing that wastes in storage before the effective date of the rule may retain existing codes and remain in storage with the existing waste description up to the time of treatment or disposal. New waste codes must be assigned before removal of the wastes from storage for treatment or disposal. In this manner, reclassification of

stored waste would not have to be conducted all at once, but would, nevertheless, have to be conducted before ultimate disposition of the waste. Although generators may reclassify these wastes on the basis of generator knowledge, in some cases reclassification of the waste streams under the new codes could require opening and examining existing drummed wastes.

XIV. COST ANALYSIS

A. INTRODUCTION

The State of Utah Solid and Hazardous Waste Act, Section 19-6-106, defines requirements that the Solid and Hazardous Waste Control Board must satisfy in developing rules that are more stringent or broader in scope than corresponding federal regulations. These requirements include developing documentation supporting the position that existing federal regulations that could be adopted by the state are inadequate to protect public health and the environment. The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW) has therefore included a cost analysis as part of today's proposed rule. DSHW believes that this cost analysis is especially important considering that, ultimately, it is the taxpayer who bears the cost of these regulations, including their development, implementation, compliance, and enforcement.

B. GENERAL APPROACH

Both the Army and the state will be affected by this new rule when finalized. This cost analysis examines only those impacts that would be borne by the Army, because the costs to the state are expected to be relatively minor in comparison. As indicated previously, the proposed UCAR consists of three components: relisting chemical agents and associated wastes into more specific listing categories, establishing LDR treatment standards for wastes determined to meet the listing description, and establishing exemptions from hazardous waste regulations for certain wastes. DSHW has already indicated that its proposed relisting would regulate essentially the same wastes as hazardous that were regulated under the July 1988 rule. Additional analyses may be required, however, considering that new hazardous constituents have been added to the rule (e.g., agent breakdown products). Even so, there will be minimal impact on the Army due to new wastes or hazardous constituents that would be regulated as hazardous wastes. The Army will, however, need to modify its existing permits and associated documentation (e.g., waste management plans, SOPs) to reflect the new listings and waste categories.

The LDR treatment standards impose treatment requirements on agents and associated wastes that meet the listing descriptions. DSHW, as indicated previously, is proposing both technology-based and concentration-based LDR treatment standards for these waste streams and is providing the Army with the opportunity to select which standard to apply for specific waste streams.

Technology-based standards include primarily incineration and chemical neutralization. These technologies are already being applied by the Army at installations within the State of Utah under RCRA permits or other documentation (e.g., RD&D permits). Because these technologies have already been shown to meet the concentration-based standards (see Preamble Sections IX and XI), no analyses would be required if the Army chooses to apply the technologies. The Army will, however, experience the costs of sampling and analysis if it chooses to apply the concentration-based LDR standards. A cost is also associated with permit modifications to incorporate LDR requirements.

The third aspect of today's proposed rule is the exemption. This aspect of the rule provides the Army with the opportunity to save resources. However, a significant cost is associated with the waste analyses that would be required. In addition, because of the low exemption levels that are proposed for the constituents, the Army may need to modify existing analytical methods to increase sensitivity. A cost may therefore be associated with analytical method modification. Exempted wastes will be managed within the state under the RCRA Subtitle D program (for solid, nonhazardous wastes). A cost is associated with management of Subtitle D wastes as well.

In summary, there are several overall considerations with respect to today's proposed rule that affect cost:

1. For the most part, wastes currently regulated as hazardous would continue to be regulated as hazardous under the new rule, as proposed. The Army is already disposing of these materials in compliance with the state's hazardous waste laws. The primary cost impact associated with the relistings would be due to permit modification and associated activities (e.g., training).
2. For the most part, the LDR technologies are already being applied to the chemical agents and associated waste streams. New technologies need not be developed or demonstrated in order to comply with today's proposed rule.
3. Waste analyses are not required in order to comply with the LDR aspects of today's proposed rule. The Army can avoid the costs of analytical testing if it applies the technology-based standards in lieu of the concentration-based LDR standards. The primary cost impact associated with the LDR also would be due to permit modification and associated activities (e.g., training).

4. The rule provides the Army with the option to seek exemption of certain wastes from RCRA Subtitle C requirements. A significant cost would be associated with waste analyses and also permit modification. However, these costs would be offset by the cost savings associated with waste declassification.

In consideration of these factors, DSHW has chosen to limit its cost analysis to only the cost associated with permit modifications. Included are the costs of the modification itself and of associated documentation, and the cost the Army will incur to train its staff on compliance with new requirements.

C. PRELIMINARY ANALYSIS

This preliminary cost analysis pertains to those costs associated with permit modifications and associated documentation and activities. To comply with the new rules, the Army would be required to submit permit modifications or permit application modifications for each of its operations in Utah. These operations include DPG, CAMDS, TOCDF, and DCD. DPG, DCD, and TOCDF are presently operating under full RCRA permits; CAMDS is operating under a RD&D permit, but it is presently seeking a full RCRA permit. It is assumed for this analysis that all four operations are fully permitted under the 1988 rule before today's rule goes into affect. Because the permit modification will be in response to the UCAR, a major new rulemaking, it is assumed that all permit modifications would be Class 3 modifications.

Representatives from each of the installations were polled as to the projected cost of the Class 3 permit modification that would affect waste listings, treatment requirements, and exemptions and that would include the costs of implementation (training). The cost estimate for all four activities, including the cost for regulatory review, totaled \$2,250,000. This estimate includes the following activities:

- Initial and follow-up meetings with regulator;
- Support to DSHW during public meetings;
- Preparation of draft, interim drafts, and final permit modification documentation;
- Update of waste management plans and similar documentation;
- Update of SOPs and similar documentation;

- Internal Army coordination and approval; and
- Training.

D. SUBSEQUENT ANALYSIS

Economic analyses in support of major environmental rulemakings are typically very complex. Historically, such analyses have involved detailed examination of implementation costs, including replacement costs, present value, discount rates, inflation rates, projections into the future, and other considerations. In addition, such analyses also typically examine the benefits that would be achieved by the regulation, with an assessment against the costs. Also, costs can be highly variable because of variation in waste generation rates, which for the Army, can vary drastically as a function of several factors, such as wartime vs. peacetime conditions. Finally, such an analysis could be further complicated by considering whether agent wastes exhibit federal RCRA characteristics or are derived from or mixed with federally listed hazardous wastes.

DSHW has chosen, for today's proposed rule, to conduct a very basic analysis of cost. DSHW believes this action is appropriate considering that the costs associated with the rule are relatively low, and that the cost savings associated with the exemption are not included in the analysis.

DSHW will conduct a more detailed cost analysis for the final rule if it determines, after examining comments received from the public during the comment period, that such an analysis is necessary.

XV. LIST OF REFERENCES

The following references are available in the Administrative Record for the proposed rule. Included in the Administrative Record are copies of the rule and preamble, supporting background documents, and existing permit documentation for each of the Army's operations in Utah, specifically, for DCD, TOCDF, CAMDS and DPG. Key references for Background Documents B (Chemicals Proposed for Regulation), C (Chemicals Evaluated But Not Selected as Constituents of Concern), E (Derivation of Health-Based Environmental Screening Levels (HBESLs) for Chemical Warfare Agents), H (Incineration as a Land Disposal Restriction Treatment Technology for Chemical Agent Associated Waste) and I (Chemical Neutralization as a Land Disposal Restriction Treatment Technology for Chemical Agent Associated Wastes) are listed at the end of those documents and copies are also included in the administrative record.

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